POPULAR SCIENCE

Oct. 1949

25¢

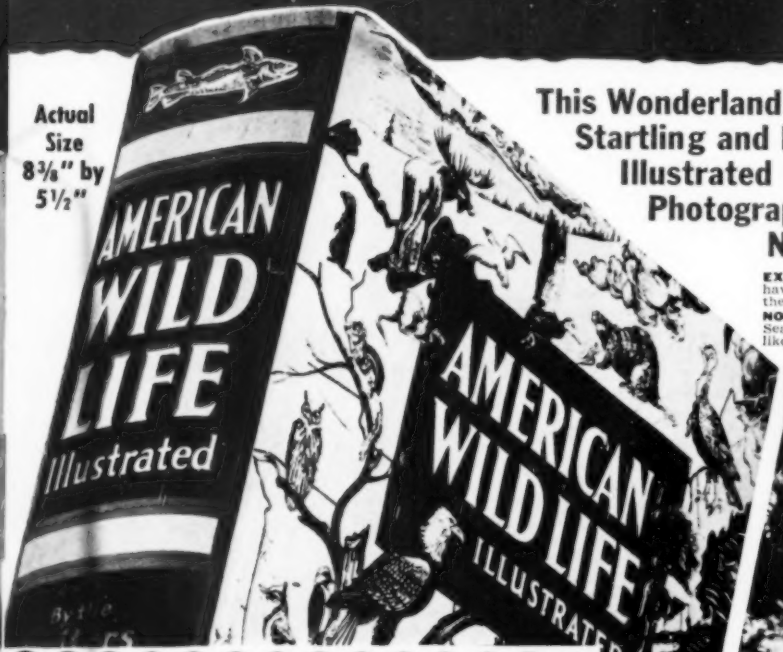
Monthly

Scoop-Wing Plane Leaps Off Lawn

PAGE 106

Thrill to the Wonders of *American*

Actual Size 8 3/8" by 5 1/2"



This Wonderland of Living Things—Startling and Beautiful—Lavishly Illustrated with Hundreds of Photographs—Some in FULL NATURAL COLORS!

EXTRA LIDS (Top picture). Alligators have extra eyelids—transparent—enabling them to keep their eyes open under water. **NOSE LAMP (below, left).** Female Deep Sea Angler lures puny male with beacon-like tentacle. She's 1000 times bigger than he!

"FISHING TRUSTS" Are formed by pelicans who cooperatively hunt fish, scooping up schools of them in their pouched bills!

GROWING UP. This Bla Bear Cub, no bigger th a canteloupe at birth, ea ants and wasps while h elders dine on cattle!

In the Partial List of Subjects Below You Get Just a Glimpse of the Wonders in this Superbly Illustrated American Wild Life Book!

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Whales
Dolphins and Porpoises
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Bison
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Caribou
Moose, Deer
Peccary
Hares, Rabbits
Porcupine
Jumping Mouse
Mountain Beaver
Muskrat
Beaver
Pocket Gopher
Woodchuck
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Squirrels
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Wolf, Fox
Badger
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PREHISTORIC MONSTER? NO! It's the Pacific Horned Lizard, or Horned "Toad" and it's quite real and alive!

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Multiply such a patch of wild life near your home by the length and breadth of America and you have one of nature's greatest and most varied collection of living wonders on the face of the earth. To witness the daily lives of these wild creatures has been the privilege only of the fortunate few, possessing the time, knowledge and equipment necessary for close observation. Now, however, this fascinating animal world is brought to you within the covers of one wonderful, exciting volume, to be enjoyed comfortably at your leisure. Here at last is a book to open your eyes to the marvels of American Wild Life in brilliantly accurate and profusely illustrated stories!

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Monthly

OCTOBER, 1949

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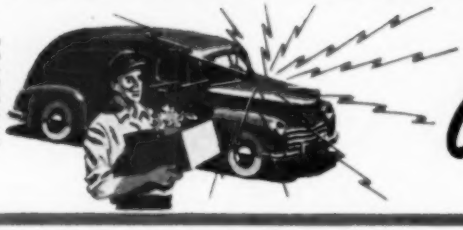


Checked by

British Bill Would Curb Spark Plug Interference With Television

London—The Government announced tonight that it is enacting legislation making persons subject to $400 fine and possible jail sentence of three months for causing interference during peak radio and television periods. For example, motorists will be asked to fit suppressors to their motors.

It can happen here!

HERE'S THE PROBLEM

Few people realize that a major cause of faulty television reception, particularly in areas where the television signal is weak, originates not in the set itself but from ordinary spark plugs in nearby automobiles. This poor reception, jumping and wobbling in the image, comes from the radiation of the electrical discharge in passing vehicles—your car, your neighbor's, or delivery cars or traffic on your street. The ordinary automobile spark plug acts as a miniature broadcasting station that frequently spoils what would otherwise be clear, sharp television images.

Read What Television Experts Say:

FRANK STANTON, *President, Columbia Broadcasting System:* "There is no question in my mind that ignition interference is a contributory cause to poor television reception. The resistor type spark plug appears to be the answer."

J. R. POPPELE, *President, Television Broadcasters Association of America:* "Interference by automobile ignition systems to television is quite common and is often very severe in outlying areas. I have witnessed tests in which the new Auto-Lite Resistor Spark Plug was very effective in reducing interference to television receivers under such conditions."

W. R. MacDONALD, *President, Radio-Television Institute:* "The sooner every car and truck in America is equipped with the new Auto-Lite Resistor Spark Plug, the better it will be for the television industry and everyone who owns a television set."

An authoritative article, "Television Brings Change in Car Ignition Behavior," reprinted from the S.A.E. JOURNAL published by the Society of Automotive Engineers, is available without charge.

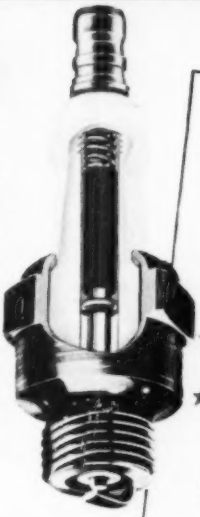
The effect of ordinary spark plugs on the TV image is shown in this scene from Auto-Lite's "Suspense!" show, "The Creeper," starring Nina Foch and Anthony Ross.

BY ORDINARY SPARK PLUGS

AUTO-LITE *Resistor* Spark Plugs

HERE'S THE ANSWER

The new Auto-Lite Resistor Spark Plugs check television interference normally caused by ordinary spark plugs. Blurred, flipping and distorted images, due to this type of interference, become clear pictures like the one at right below. So install Auto-Lite Resistor Spark Plugs in your car—urge your neighbors and neighborhood delivery service to use this better plug too. This "good neighbor" policy will help everyone in your community enjoy television at its best. It's easy to do . . . switch to Auto-Lite Resistor Spark Plugs!



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Permits burning of leaner mixtures and reduces misfiring.

★ **INCREASED ELECTRODE LIFE**
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★ Cutaway view shows the 10,000 Ohm Resistor which permits wider initial gap settings to make possible the extra benefits obtained from Auto-Lite Resistor Spark Plugs.

Auto-Lite Spark Plugs—Patented U.S.A.

This clear image shows how better television is possible when Auto-Lite Resistor Spark Plugs check interference. The scene is the same as that shown at the left.

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Shoptalk:

What are they talking about?
Where do they work? Answer below.

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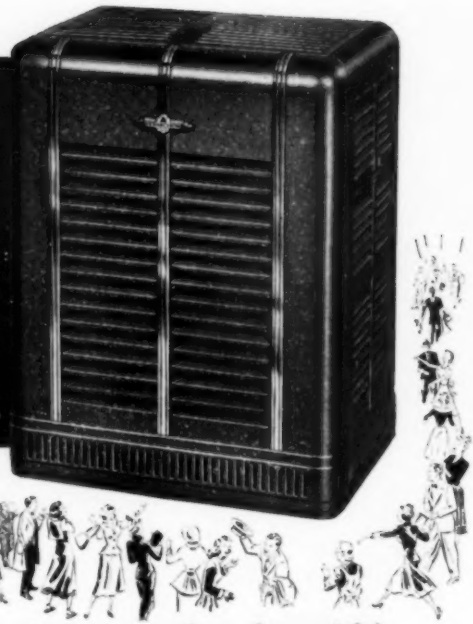

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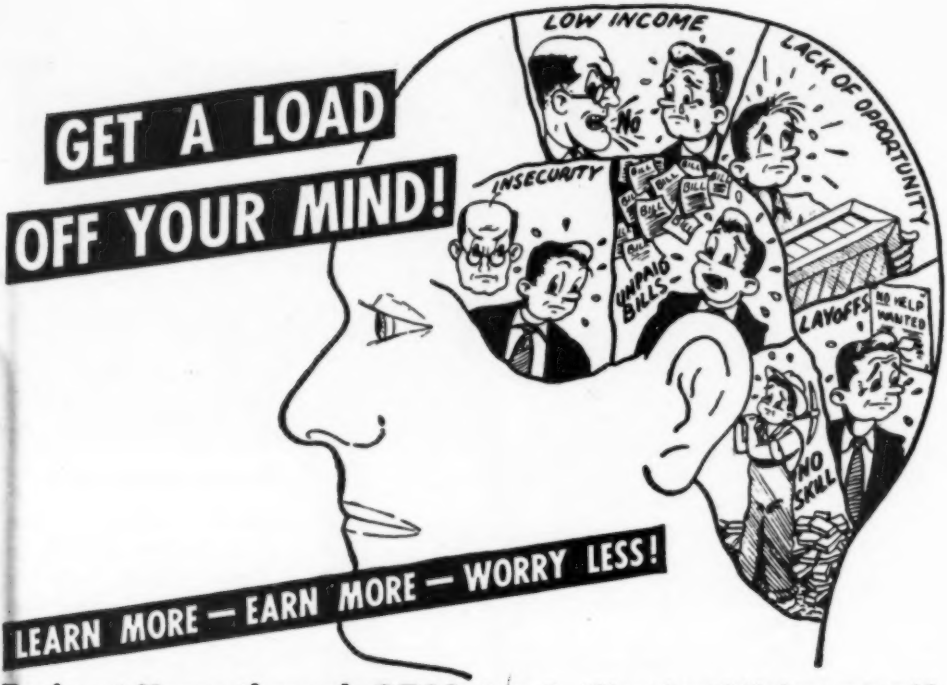

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Letters

Satisfied with Old Moon

Sir:

I should think that the science world would see fit to expend its wisdom on something of more positive potential value than "building a new moon" [PS, May '49, p. 106].

Somehow it seems that this feat, even though inviting, is an impossibility. Let us assume that the earth is a round plate so as to simplify my thesis. We now draw one radial line and extend same into and past the last assumed rarefied circle of the earth's atmosphere. I believe that in this region the gravitational force or attraction on any missile is assumed nil.

Let us now assume our rocket will travel along this radial line beyond gravity. Our rocket now intercepts no resistance. It also moves through space at a constant speed. I can't see any common sense in believing that the rocket can possess some oddity that will enable it to turn of its own volition and travel in a curve around the earth.

R. Klingbeil

Woodhaven, N. Y.

You make one too many assumptions. The earth's gravitational attraction does decrease as you go out into space, but it is by no means "nil" at 22,300 miles away—the farthest distance suggested for PS' orbiter. Gravity would keep the orbiter circling the earth in the same way that it keeps the real moon in its path—and that's about 240,000 miles away.

You Can't Please Everybody

Sir:

I am getting disgusted. When I started buying Popular Science I enjoyed it very much. Now my interest is slowly growing dimmer. Why? Because Popular Science now has more mechanics in it than it has science. The greater part of the articles tell about the advancements in the more mechanical fields such as progress in engine design and construction, new inventions in the automotive field and even different construction ideas on building a more roomy

"What's he got that I haven't got?"

LOOK at the successful men you know. "What have they got" that you haven't?

Very little, probably. In most ways these men are no brighter or naturally more capable than average. Many of them probably have no more formal education or better natural aptitudes than you.

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home. Such articles are all right in their place, but I don't think their correct place is POPULAR SCIENCE. Why don't you live up to the name of POPULAR SCIENCE and insert more articles which will arouse real scientific interest? I think if you would devote more pages to such fascinating subjects as chemistry, astronomy, physiology, biology, atomic energy, and medicine it would raise POPULAR SCIENCE magazine to a greater magazine.

ROBERT E. ZRAIK

Toledo, O.

On the other hand . . .

Sir:

I like your magazine very much, but one thing I don't like is stuff about atoms and things that take high-geared brains to read. I'm not that smart. Excuse me if I'm blunt. I like things like making things for the darkroom and cameras.

CHESTER LEWIS

St. Louis, Mo.

What PS tries to do is serve up a "balanced meal" that covers the wide range of science and mechanics. No reader is expected to like everything in every issue, just as no restaurant patron is expected to like everything on the menu. But that doesn't mean you can't get enough to eat.

Credit Where Due

Sir:

I was particularly interested in the article "Steam Now Cools, Too," appearing in your August issue on page 136. The article states that the Carrier Company has developed a new air-conditioning system whereby waste steam is utilized to produce cooling. This certainly is not anything new—just the old "absorption system," developed years ago.

Servel, Inc. has been manufacturing an air conditioner for the past ten years that cools in the summer and heats in the winter by steam.

RAY D. FREEMAN

Louisville, Ky.

Servel says it was the first to introduce an air-conditioning system of this general type, but that it was designed "for residential and small commercial usage." Carrier's system, for large applications (theaters, department

Continued on Page 18

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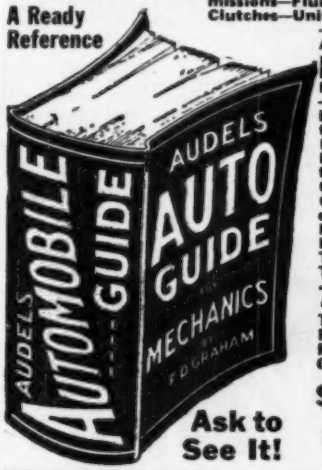

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LOREN D. SAUCIER of Coloma, Mich. reports that my training has made it possible for him to repair large numbers of Radio and Television sets.

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"Hot Wires" Gets Warm Welcome

Sir:

I found the article entitled "How Linemen Handle Hot Wires and Stay Alive" [PS, July '49, p. 144] by George H. Waltz, Jr. to be most interesting and instructive.

At the last meeting of our local I brought this article to the attention of the members and requested that they read it. It was found that some had read it, and a number of those present were deeply interested.

ROY F. CARAHER
International Brotherhood Electrical Workers
Utica, N. Y.

Unsung Heroes

Sir:

I would like to take this opportunity to thank the staff of PS and especially Devon Francis for the article "How Motion Pictures Are Projected" in your August 1949 issue [p. 150].

At last a mention has been given to a very important phase of a great industry. Hardly anyone notices the projectionist in the booth at all.

However, we are still there and thousands of projectionists and engineers in theaters and laboratories all over the United States, Canada, and the world are constantly working and striving to achieve even better and greater results for you.

MICHAEL D. HALL
Projectionist, "Metro" Theater
New Westminster, B. C., Canada

Argument for Superbombers

Sir:

I read with interest the article in the August issue "Can Superfighters Stop the Bombers?" [p. 90]. However, I think that you have a good answer to a poor question.

It seems that neither you nor many of our national figures fully realize the importance of the development of the V-2 rocket. Fortunately for us Mr. Hitler had no atomic bomb to put in the nose of his V-2. As a former lead bomber pilot in Europe I had the experience of seeing V-2s going up and hearing them come down. I believe that

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VICTOR F. PFENDLER

Cleveland Heights, O.

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Sir:

Having been a projectionist for about 15 years, I feel your article "How Motion Pictures Are Projected" [Aug. '49, p. 150] could stand some revising. First: "The first dots warn that it is almost time to switch reels." It is no warning whatsoever, it is a clue to start the motor.

Second: "In a moment he switches on the current to start the second machine rolling." This sounds as if he just starts it at random; actually he starts it when he sees the first clue as previously stated.

Third: "Practice tells him when his 20 feet of "leader" will have run past the film gate." He does not rely on practice; he relies on a pair of signals. Furthermore there is not 20 feet of leader. Most operators "thread" on a figure 8, which means there are 8 feet (not 20) to run past the film gate.

Fourth: "An ingenious variable-speed motor feeds the positive carbon into the arc at just the rate that the carbon is burned." What about the negative carbon? It would be hard to keep a good light on the screen if the motor feeds only the positive carbon. The fact is the motor feeds both the positive and the negative carbons, keeping the arc equidistant from the film.

JAMES SCHOLL

Jamestown, Ky.

PS is grateful to Reader Scholl for the additional information on motion-picture projection. Before publishing the article, we checked it for factual accuracy with the chief engineer of the largest manufacturer of commercial projection machines.

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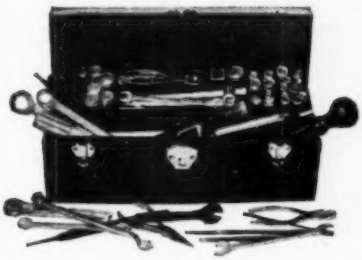

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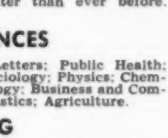

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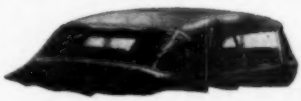

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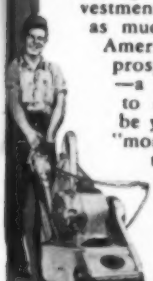

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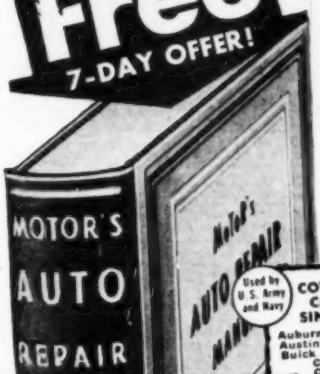

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You build several T.R.F. Receivers, one of which, a 4-tube set, is shown here. You learn construction, alignment, make receiver tests, and do trouble shooting.

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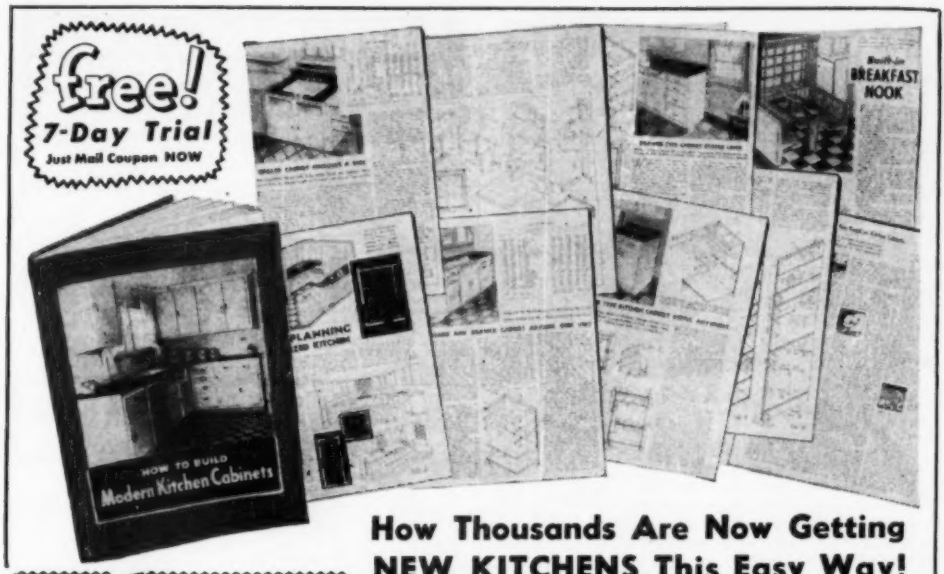

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To save time and error, the designer has prepared a cutting list in chart form. There's a chart for each cabinet, complete for whatever size you choose. This alone cuts work in HALF. All you do is cut single pieces of wood to sizes given. When all are ready, assemble into a finished cabinet!

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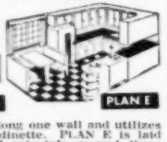
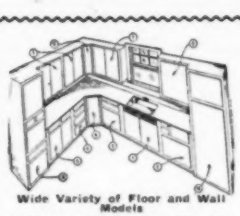
TYPICAL kitchen schemes shown here are but a few of many—many combinations you can have by selecting cabinets for your own special needs and in widths that fit your available space.

PLAN A is a suggested arrangement if you have two adjacent walls for cabinets. PLAN B gets a wide variety of cabinets into compact space along one wall. PLAN C has broom closet.



PLAN D has cabinets along one wall and utilizes corner for convenient dinette. PLAN E is laid out on the efficient U principle around three walls. Built-in breakfast nook included.



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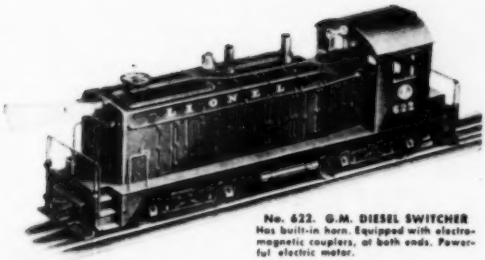

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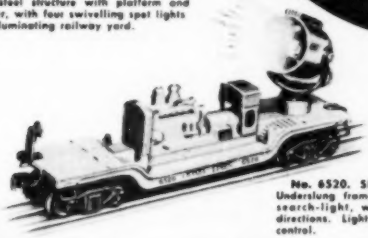

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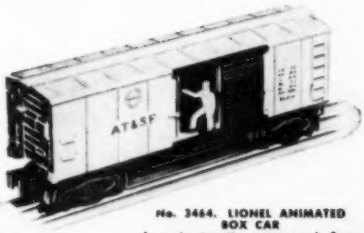

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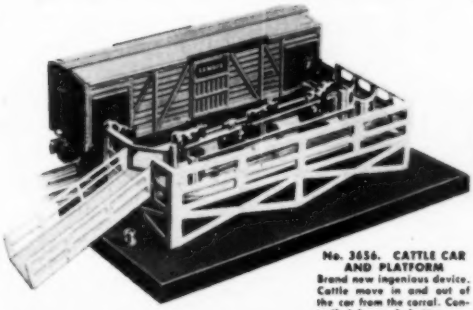

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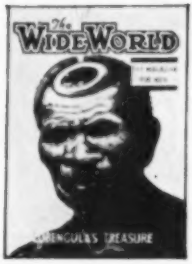

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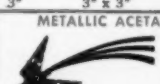

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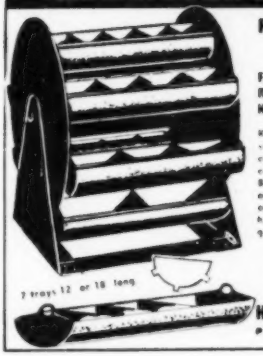

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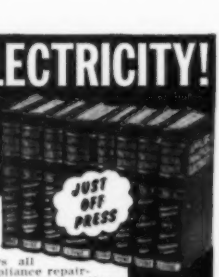

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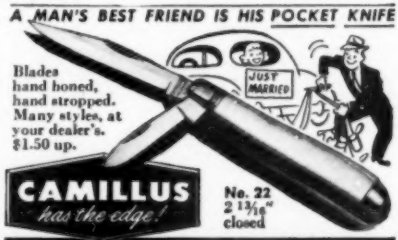

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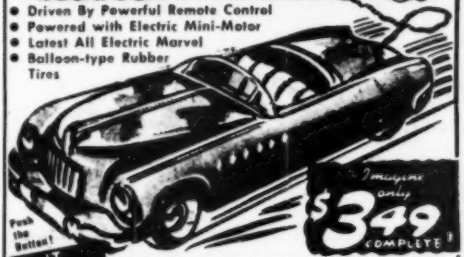

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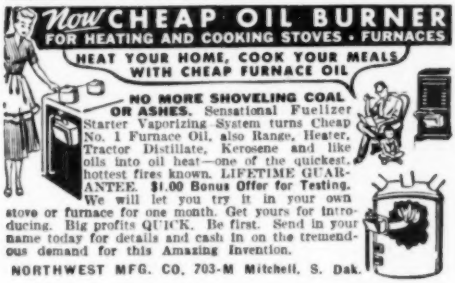

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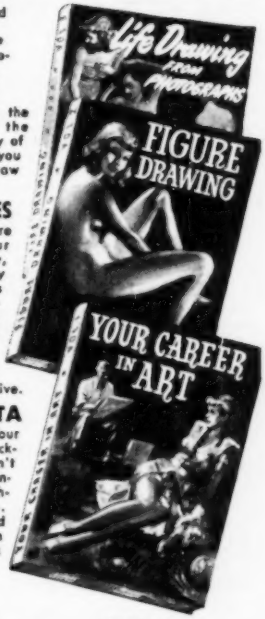

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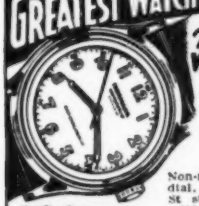

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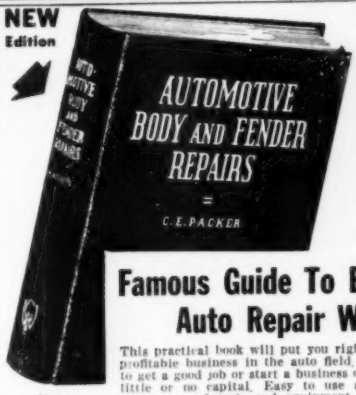

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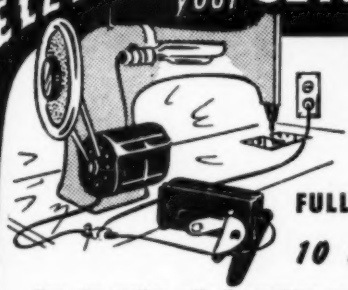

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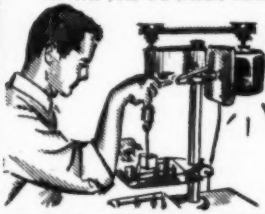

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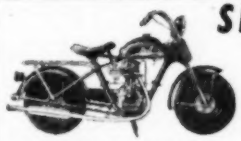

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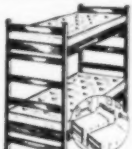

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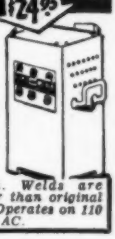

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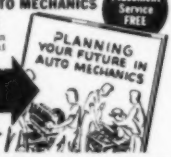

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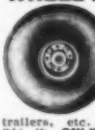

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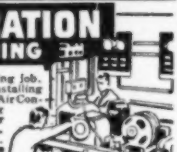

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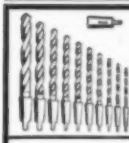

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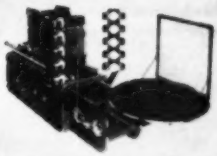

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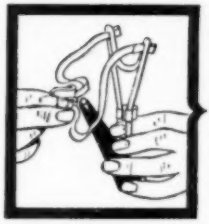

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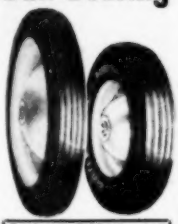

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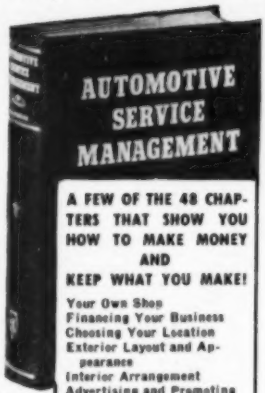

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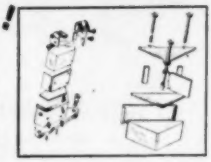

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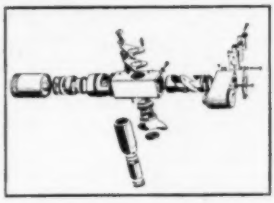
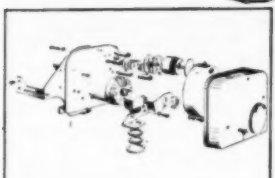


USE ON AIR, SEA or LAND

For the boatman or student of navigation the Sextant or Octant is used to determine their position on the earth's surface by means of astronomical observations of the stars, planets, etc. In the air or on the sea the navigator uses it to set his course—to accurately steer for any given point. Never before at anywhere near this price could you secure so fine a precision instrument. And it is of tremendous value to experimenters, inventors and others for the many valuable parts that make up the complete assembly.



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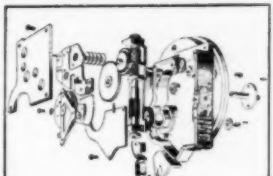

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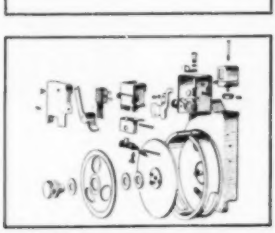

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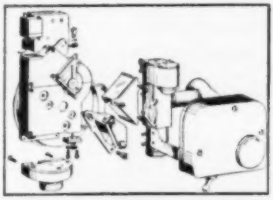

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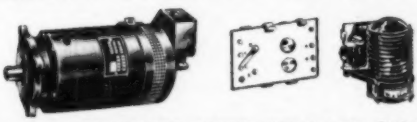

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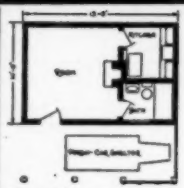

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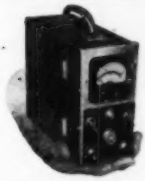

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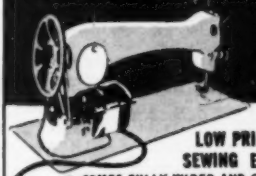

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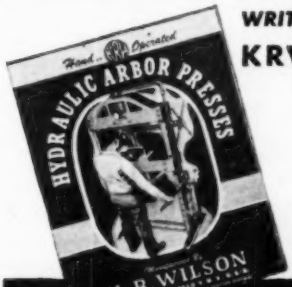

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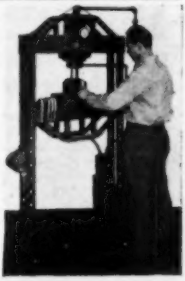

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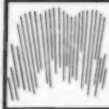

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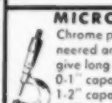

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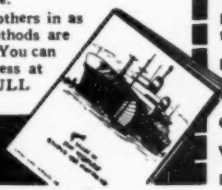

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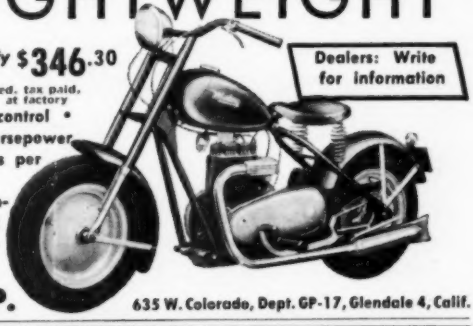

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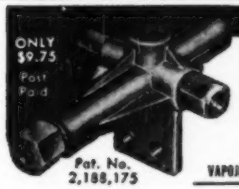

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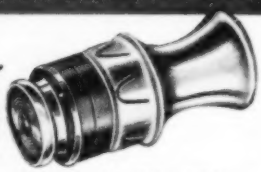

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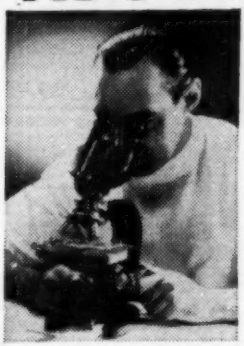
WHAT YOU CAN DO ABOUT PIMPLES



Acne, Blackheads, and other externally caused Skin Blemishes

WHEN pimply skin is your problem, the first thing to get straight is that you *can* and *should* do something about it. To develop the attractiveness of your face is not mere vanity. It is an "open sesame" towards bringing the real YOU closer to other people and giving your personality the poise and confidence it needs. Your good qualities – intelligence, character, dignity – all go to naught... are completely cancelled out by a skin that "nobody loves to touch." Remember, the YOU that people see first is your face.

SKIN PROBLEMS DEMAND IMMEDIATE CARE

Medical statistics tell us that blemished skin usually occurs from adolescence on through adult life. The problem at the adolescent stage is serious enough to deserve attentive care as a family matter. In adulthood, when life's responsibilities are so much weightier, it is doubly important to exert great effort to eliminate these blemishes. And, there is no better time to get pimples under control than *now*.

DON'T ABUSE SKIN

The first instinctive reaction to pimples and blackheads is to squeeze them out with your fingers. A bit of experimentation along these lines soon provides convincing proof that this succeeds only in inflaming your skin and spreading the infection. Under no circumstances should pimples and blackheads ever be squeezed.

Copyright 1949 by Dornol Products, Inc.

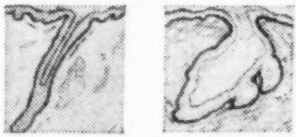
MICROSCOPE SHOWS IMPORTANT BASIS FOR EXTERNALLY CAUSED PIMPLES AND BLACKHEADS

Let's take a look through the microscope to see what's behind those unsightly pimples. The high-powered lenses show your skin coated with a covering which originated from two sources—one, internally and the other, externally.

The internal substances on your skin include dead cells, residue from the sweat glands, and a high quantity of oil excreted by the sebaceous glands. A most important factor in skin disorders occurs when thousands of these tiny sebaceous glands discharge more oil than the skin can use for lubrication. Unless special care is given, the oil forms a heavy film which attracts foreign matter to your skin much as any oil mop picks up dust. These infectious external substances may be classified into three general groups:

1. Airborne materials such as dust, pollens, condensation products of smoke, vapors, etc.
2. Materials brought in contact with the skin, such as tiny fragments of clothing, bedding, cosmetics.
3. Micro-organisms such as bacteria and fungi.

See the difference between a healthy skin and a pimply skin in the microscopic reproductions below.



A. Normal skin **B. Sick, pimply skin**

Diagram A shows a normal-size, smoothly functioning sebaceous gland. Diagram B pictures sick, pimply skin. Notice that the sebaceous gland is a swollen mass of trapped oil, waste and infectious bacteria.

TRY THIS SENSIBLE WAY

Two sensible aims to achieve in controlling this skin condition are: to clear the pores of clogging matter, and to inhibit the excessive oiliness of the skin. Toward these ends, Dornol Products' research makes available two formulas. One is to aid in thorough cleansing by highly detergent penetration which simplifies the removal of waste and foreign matter. The other is to discourage oiliness with clinically-proved ingredients, and to kill infectious bacteria often associated with externally caused pimples and blackheads.

BLEMISHES COVERED UP

To remove the distressing embarrassment of these skin blemishes, the second Dornol formula exerts a "cover-up" action on your broken out skin while the medication does its work. This, plus its pleasant odor, will spare you the mental distress which is associated with unsightly, malodorous, medicated preparations. Imagine! You can apply this Dornol formula to your skin by day and face the immediate present with greater confidence in your appearance, while secure in the knowledge that medication is acting to remove old blemishes and keep away new ones. What this "cover-up" action alone is worth in peace of mind is beyond calculation. No longer need prying eyes make you wince with humiliation and misery. Now because of this wonderful feature of the Dornol treatment, you can put your best foot forward ... at once!

SATISFACTION GUARANTEED OR DOUBLE YOUR MONEY BACK

We know what the Dornol treatment has done for others, so we want you to try it at *our risk*. A few minutes a day invested in our treatment can yield more gratifying results than you ever dared hope for. This is what we say to you: If you are not delighted in every way by the improved condition and general appearance of your skin in just 10 days, simply return the unused portion and we will refund not only the price you paid – but DOUBLE YOUR MONEY BACK! Can anything be fairer than that? You have everything to gain ... *and we take all the risk!*

How to get the Dornol Treatment immediately: Just send your name and address to DORNOL PRODUCTS, INC., Dept. 4510-C, 4257 Katonah Ave, New York 66, N. Y. Be sure to print clearly. By return mail we will ship the Dornol treatment to you in a plain package. When postman delivers the package, pay only $1.98 plus postage. Or, if you wish to save postal fee, send $2 now and we will pay postage. Which ever way you order, the DOUBLE REFUND GUARANTEE still prevails. Don't delay another minute, send for the Dornol Medicated Skin treatment with "cover-up" feature ... *at once!* Sorry, no Canadian C.O.D.'s.

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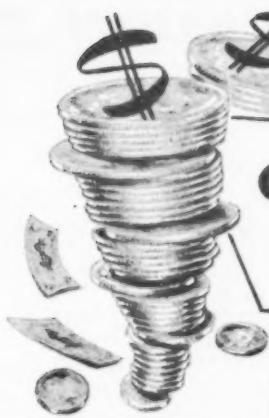

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METALLIZE Baby Shoes. Excellent profits. New system assures success. Free details. Treasures Forever, 89 Henry Ave., Lynn, Mass.

"RECESSION Blues?" Sensational new money-making plan. 33 other profitable ideas. $1.00. Halley Service, 11037-S Estepa, Oakland 3, California.

BUILD your own depression proof business. Sales-rentals-service equipment for homes and small business places. Operate from your own home. Fine opportunity for man mechanically inclined, selling ability and some capital. Write Kent Electric, Rome, New York.

MAKE Rich profits selling by mail—the "Natural" way. Hundreds successful! Interesting details free. Edward Lay, 3819 North Kenmore, Chicago 13.

EARN At home, casting novelties. Free course using latex molds. Major Chemical Co., 164 Portland St., Cambridge 39, Mass.

REAL money making opportunity making Interlocking Concrete building blocks. Rex Products Co., Dept. 21, Piqua, Ohio.

QUICK Money! "Repairing Car Batteries"! At home! Easy too! Batteryman, Grand Junction, Colorado.

BABY Shoe Metallizing. Simplified modern practical system. Schoettle, Friendship 4, Ohio.

"INDUSTRIAL Hand Cleaner." (Without Ammonia—Kerosene!) 400% Profit, manufacturing—distributing. Sample $1. Refunded, first order. Information Free. "Rythmo-H-Ex." Kingsport, Tennessee.

$46 FROM Square Foot Plywood; Jigsaw necessary. Write; Woodart, Bridgewater, Massachusetts.

HOSIERY, Sheets, Print Cloths, Etc! Wholesalers write for prices. Spartan Hosiery Company, Spartanburg, South Carolina.

MAKE Rubber Stamps, metallize baby shoes, repair dolls, silver mirrors, make plaster novelties. Catalogue of "30 Ideas" Free! Universal, Box 1076B, Peoria, Ill.

57 MONEY MAKING OPPORTUNITIES

NO selling, operate coin machines, amazing profits, details Free. Parkway Corporation, Dept. 18, 623 W. North Avenue, Baltimore 17, Maryland.

PROFIT with Larson Leathercraft. Belts, purses, 100 other ideas. Largest supply in U. S. Catalog 10c. Larson, Dept. C, 826 S. Tripp, Chicago 24.

LEARN Sewing Machine Repairing at home. Install our wholesale motor kits. Make $125 to $300 a week. Free particulars. Taylor Service Co., Hamilton PS, Ohio.

DETECTIVES Earn Big Money. Experience unnecessary. Particulars free. Wagoner, P-125, West 86th, N. Y., N. Y.

MAKE Money At Home—Cut grinding costs. Belsaw Powered Saw Gumming Machine precision Joints, Gums, Sharpens circular saws 8 to 48-in. diameter. Portable, fast, accurate. Catalog. Belsaw, 315-O Westport Rd., Kansas City, Missouri.

MAKE Money At Home as renewal headquarters for all magazines. Big profit in Christmas gift sales. Liberal commissions. Supplies furnished. Catalog Free. Write McGregor Magazine Agency, Dept. 519C, Mount Morris, Illinois.

SCHOOL Seniors—Earn 40% commission selling classmates America's Most Beautiful Graduation Name Cards. Largest selection. Outsells all others. Free sample kit. Printcraft, Dept. M, 1425 E. Elm Street, Scranton 5, Pa.

MAKE money with imprints. Complete instruction book and Big Mail only 25c. J. P. Stenger, 500—20th St., Rock Island, Illinois.

WIN Contest Money. General Contest Bulletin gives hundreds of tips. Lists current contests and rules. Sample 25c. General Contests, 1609-A East 5th, Duluth, Minnesota.

WOULD You pay 3%—first $350 made? Book "505 Odd, Successful Enterprises" free. Expect something odd! Pacific, Oceanside, Calif.

EARN—Extra money sharpening Hair Clippers of all kinds on the Heimerdinger Clipper Grinder. Write for details. W. C. Heimerdinger Co., 116 West Market St., Louisville 2, Kentucky.

"CAN You Wrap Packages?" Be popular during Christmas. Valuable throughout lifetime. Interesting gift, selling item. Copy, profitable offer, $1.00. Holbrook Books, Box 1802, Milwaukee, Wisconsin.

ADDRESS, Mail circulars for advertisers. Full information and list of firms—25c. Write for other offers. Imperial, Dept. PS10, 902 South 9th, Wilmington, N. Car.

HOW To Make Money In Plastics. Learn Plastics at home, in spare time. You get 7 Big Plastics Material Kits with training course. Make useful, valuable articles as you learn. Send today for free illustrated catalog. Plastics Industries Technical Institute, Dept. of West Coast University, 1601 S. Western Ave., Dept. CPS-109, Los Angeles 6, California.

SELL merchandise by mail. Easy and profitable. Everything furnished. Home City Services, Box 1062S, Springfield, Mass.

HAVE Your Own Big-Money Business! Others are making up to $500 monthly in waterproofing and cement painting. Let me prove you may do as well! Few dollars starts you. Interesting facts, free. Write today! Edgar W. Thomas, Barnesville 1, Ohio.

MAKE extra money at home in spare time. Raise Golden Hamsters. Small investment. Literature free. Golden Gate Hamstery, 631-G Richmond St., El Cerrito, California.

FREE California land. Information 25c. Cowan, Box 561, Berkeley, California.

CASH for simple Ideas. Household & Shop Hints. E. W. Moses, Jr., Blacksburg, Va.

15 MINUTES masters advertising and sign lettering, complete system; sign painters' secrets; cartooning book; all three, $1; free circular. Abenterprizes, Box 875-A, Peoria, Illinois.

EARN Money Evenings, copying and duplicating comic cartoons for advertisers. Adservice, Argyle (2), Wisconsin.

$50 WEEKLY while learning Watch-Clock Repairing. See ad page 45.

58 FORMULAS, PLANS, ETC.

FORMULAS—All kinds. Latest products. Literature free. Kemico, Park Ridge 15, Illinois.

10,000 FORMULAS and trade secrets. Free Literature. Stillmans, 555 Kingston Ave., Brooklyn 3, N. Y.

PRODUCTS analyzed. Duplicated. Improved. Formulas. Consulting Scientific Company, Swarthmore, Pennsylvania.

SNOWBOUND? SnowCar detailed working drawings—Parts list—$10.00. Callair, Afton, Wyoming.

50 SINGLE Ingredient Formulas 25c. Siegel, Box 183, New York 2.

LABORATORY tested formulas. Lists free. Pont, Box 635-PS, Terre Haute, Ind.

59 PLASTICS

PLASTIC supplies, materials, instructions for hobby or business. Send for free catalog. Tells about internal carving. Hays Plastics, 2333 Lincoln Avenue, Alameda, California.

LUCITE, Plexiglas. Any size sheets, masked. Square foot (12 x 12) cost, 1/16", 96c; 1/8", $1.25; 3/16", $1.52; 1/4", $1.80. Colors add 10%. Include 10% postage. Almac Plastics, 230 Fifth Avenue, New York 1, N. Y.

INTERNAL carved roses, orchids, swans, goldfish, butterflies, etc. Jewelry and gifts. Crystal Floral Novelty Co., Bound Brook, New Jersey.

WHOLESALE Plastics supply catalog 10c. Lucite, clear, colored. Metallic Acetate. Complete Castolite line. Phosphorescent, pearlizing pigments, dyes. Metal findings. Tools. Ideas—bargains galore. Fast delivery from stock. Gem-O'-Lite, Box 686K, North Hollywood, Calif.

CASTING Plastics: Cold Curing Transparent and Colors. Information 10c. Alan Plastics, Dept. S1, Box 3564, Cleveland 18, Ohio.

POPULAR SCIENCE OPPORTUNITIES

PLASTIC. Sheets, Rods, Tubes, etc. Free List. Plastic Supply Co., 2901 N. Grand Blvd., St. Louis 7, Mo.

PLEXIGLAS—Write for Free Price List. The Unique Glass Shop, 309 Cowardin Ave., Richmond, Virginia.

SPECIAL ¼" 12"x12" Prime Plexiglas $1.75 include 10% Postage. Free Catalogue. Craft Plastics, Somerville, New Jersey.

NEW plastic fabricating manual and catalog, 32 illustrated pages. "How to Work Plastics." Complete list of plastic supplies and accessories. Send 20c. House of Plastics, Dept. CF, 8648 Linwood, Detroit, Michigan.

60 CHEMICALS AND APPARATUS

NEW Idea Chemical and Apparatus Outfits for Home Experimenting, Photo-Scales, Microscopes, Chemicals, Biological and Laboratory Supplies in Small Quantities. Catalog 15c. Established 1931. John H. Winn, 124-B West 23rd Street, New York, N. Y.

NEW Laboratory supply catalog of Chemicals and Apparatus. Contains many thousands of items with illustrations. Send 25c. Standard Science Supply Company, 1232 N. Paulina St., Chicago 22.

LUMINOUS Paints will glow in dark. Six colors. Fairmount Chemical Co., 136 Liberty St., New York City 6.

NEW catalog: Chemistry, mineralogy, biology, physics 10c. Tracey Laboratories, Evanston, Ill.

CHEMICALS and apparatus for industrial, analytical, and private laboratories. Catalog 15c. Dept. M-26, Biological Supply Co., 1176 Mt. Hope Ave., Rochester 7, N. Y.

NEW, used. Catalog 10c. Atlantic Laboratory Supply, 21 Wenham, Boston, Mass.

61 HELP WANTED

BOYS Wanted. Over $2.00 hour! Sell name plates for front doors. Free Sample. Write Dept. 71, National Engravers, 214 Summer, Boston, Mass.

ALASKA. The Last Frontier offers unlimited opportunities. $1 brings government map and Directory listing firms in Fishing, Construction, Mining, Aviation, Fish & Game rules, Homestead data. Alaska Opportunist, Box 883-S, Hollywood 28, Calif.

$1,000,000 CONSTRUCTION Job Project Report. $1.00 brings Monthly News Bulletin giving authentic projects starting "world wide." U.S.A., Alaska, Canada, Pacific, Arabia, Latin America, India, Mexico, Africa, Europe. Tells How-When-Where to apply. Global Reports, P. O. Box 883-PX, Hollywood 28, Calif.

INTERESTED In Latin American And Foreign Employment??? $1.00 brings copyrighted "Foreign Service Directory" with complete listing of firms in Oil, Mining, Aviation, Construction, Steamship, Manufacturers, Importers and Exporters with Hot Tips for immediate application. Published since 1944. Global Reports, P. O. Box 883-S, Hollywood 28, Calif.

IMMEDIATE opening for reliable man with car to call on farmers. No experience necessary. $15 to $20 in a day. Permanent. McNess Company, Dept. 179, Freeport, Ill.

FOREIGN Employment. Construction men, building trades mechanics, helpers, office men. Good workers needed for oil projects, mining, pipe lines, dams, power plants, roadways, shipping, etc. Transportation and quarters furnished; high wages. Listings of firms actively working and hiring on projects in South America, Arabia, Asia, Africa, Alaska, Central America, etc. Send $1.00 for foreign construction compendium and application forms. Foreign Service Bureau, Dept. P.S. 10 (Employment), P. O. Box 295, Metuchen, New Jersey.

CALIFORNIA Job Opportunities, Job openings, Industries presently hiring, wages, housing, rentals, living costs, etc. Send $1 for Complete Information to: California Opportunities, 749-3 No. Broadway, Los Angeles 12, California.

MEN-Women mail circulars spare time at home. Good pay. Mail 25c for samples. Instructions. P.S.-2441 N. Patton, Philadelphia 32, Pa.

FOREIGN Employment?? List of Overseas projects with application form, $1.00 Cash (C.O.D. $1.32). Foreign Service Institute, Box 3980, Miami 24-A, Florida.

62 AGENTS WANTED

GOOD Paying Business Silvering mirrors, plating autoparts, reflectors, bicycles, bathroom fixtures, etc., by late method. No tanks or shop required, outfit furnished. Free Booklet. Gunmetal Co., Ave. G, Decatur, Illinois.

EXCELLENT Sideline for printing and advertising salesmen. Decalcomania name plates in small quantities. Great demand. Also, make money with our line of Automobile Initials and Sign Letters. Free Samples. "Ralco", XL-Roxbury, Boston 19, Mass.

AGENTS—300% profit selling genuine gold window letters; stores and offices. Free samples. Metallic Letter Co., 437 N. Clark, Chicago.

FREE water and our concentrates make flavors, lotions, shampoos, 125 products. Labels, bottles supplied. Qualco, F-20030 Russell, Detroit.

PHOTO-Salesmen-Agents. Sell beautiful hand-colored plastic enlargements. Collect deposit, we deliver. Profitable sideline. Send card for free sample kit. Novel Portrait Co., 3343-A North Ave., Chicago, Ill.

SEWING Machine electrification kit. Nationally advertised. Has Good Housekeeping Guaranty Seal. Can be demonstrated and sold in 5 minutes. Make at least $5 per sale. For complete details write today to Brownell Distributors, Inc., Dept. PS, 308 Canal St., New York 13, N. Y.

LOOK! Make money all year round selling personal initialed individualized belts, buckles, cap badges, western buckles, tie holders, name plates, 2000 emblems to choose. Big profits, whole or part time. Please write today special outfit offer. Hook-Fast Specialties, Box 1425, Dept. 7, Providence, R. I. Established 1926.

WOULD you pay 3¢—first $350? Book "505 Odd, Successful Enterprises" free! Work Home. Expect something odd! Pacific, Oceanside, Calif.

BIG Money—Fast! Sell Plastic Tablecloths (From $3.50 Doz.), Drapes, Aprons, over 300 other items. Cash advanced Daily. Lowest Factory Prices; Highest Quality Plastics! Huge Selling Kit Free! The Dur-Ever Co., 2781-N Atlantic Ave., Brooklyn 7, New York.

FREE Folio. Wholesale Supply Sources. Business deals, Plans, Ideas, Formulas. Kolamite Co., Box 572 C, Dayton, Ohio.

SELL Slot Machines, Games, Home Bars. Send for wholesale deal. Webb Distributing Co., 4966 West Chicago Ave., Chicago 51, Ill.

AGENTS! 100 Brand New Products. Confidential Bulletin Monthly. Publishers, Gardenville 4, N. Y.

SELL!! Balloons, Combs, Specialty Merchandise. Carleton House Distributors, Texas City, Texas.

PAINTS—Enamels, Roofing 65c gallon up. Also outdoor toilet cleaners. Certified Products, 812f 38th, Louisville, Ky.

BE first! Clean up selling brilliant new, metal Christmas cards featured in America's greatest box assortment line. Special metal, plastic, foil and novelty assortments. Five portfolios of personal cards. Fast imprint service. Free samples. Elmcraft Chicago, 5930 South Western, Chicago 36, Ill.

POPULAR-Priced Sportswear, Shirts, Jackets, Pajamas, Nylons, Housedresses. Tremendous Commissions. Free Outfit. Jarod Manufacturing, Rockville Centre 6, New York.

AGENTS make $100 easy! Sell only 100 extra-profit Xmas card deals. Cost 75c—profit $1 per deal! Complete line Free imprint samples; also approvals. Make more with Creative Art, 45 Warburton, Yonkers, New York.

$1.00 STARTS you in business. Sell top quality $1.00 ties. Now only $7.20 dozen, your profit $4.80 dozen. Regular $1.50 up values. Send one dollar for introductory offer two ties. Catalog complete line free. Philip's Neckwear, 20 West 22nd Street, Department P-37, New York 10.

NEW Jobs open in selling! Send name, address for five free issues of Opportunity Magazine's money-making guide, listing hundreds of companies who'll pay you well, full or part-time. No experience needed. Opportunity, 28 E. Jackson, Dept. 18, Chicago 4, Ill.

START Your Own Business On Credit. Always your own boss. 1554 Dealers, sold $5,000 to $26,500 in 1948; their average $6,742. We supply stocks, equipment on credit, 200 home necessities. Sales experience not needed to start. Wonderful opportunity to own pleasant, profitable business backed by world-wide industry. Write Rawleigh Co., Dept. J-U-PSC, Freeport, Ill.

ABSOLUTELY Free! Big package actual sample fabrics and style presentation of dresses, lingerie, hosiery, etc. Take orders. Commissions big. Send no money. Melville Co., Dept. 5104, Cincinnati 3, Ohio.

A DRESS Yours with every 3 you order for yourself and family. Amazing new bonus plan. Everything Free. Harford Frocks, Dept. A-535, Cincinnati, Ohio.

FREE Samples. Big profits showing amazing Glow-In-The-Dark specialties. House numbers, pictures, plastic novelties, religious and nursery objects, etc. Large manufacturer. Madison Plastics, 303 Fourth Ave., New York 10, N. Y.

1949 CHRISTMAS Card Catalog Now Ready! Earn more Money! Be a wholesale Jobber! A large selection of Box Assortments, Imprint Lines, Religious, Personalized Cards and Christmas Novelties. Three sample boxes, retailing for $2.60, only $1.00 postpaid. Catalog Free! Elfko, 440 North Wells, Chicago 10.

STOP! Want to make money all year round selling a complete line. Wool and Cotton Embroidered Uniforms for summer and winter wear, shirts, caps, ties, badges, 2000 emblems, personal initialed buckles, belts, and hundreds of other easy-to-sell items. Sales Kit furnished. Please write today. Hook-Fast Company, Box 480 PS, Roanoke, Va.

EARN Big Money Fast! Sell finest-quality advertising work uniforms to garages, factories, filling stations, etc. Free selling kit. Topps, Dept. PS-109, Rochester, Indiana.

$100.00 WEEKLY selling 6 pair Paragon Cushion shoes daily. No investment. Experience unnecessary. Free outfit, Samples, Advance commissions, bonus. Paragon Shoes, 738 Columbus, Boston.

BE Renewal Headquarters for all magazines. Big profit in Christmas gift sales now. No experience—No capital needed. Free Catalog tells how. Write: McGregor Magazine Agency, Dept. 519A, Mount Morris, Illinois.

$5—$25 DAILY. Full, Sparetime or Sideline. Pocket Samples Free. Centson Cards, 3333 Neenah, Chicago 34.

FAST profits—No investment. Send for big, free catalog. Plastic aprons, tablecloths, etc. 150 sure-fire items. We guarantee sales. Write The Halliday Company, Dept. P-10, 347 Broadway, Passaic, N. J.

WHOLESALE Vitamins, Minerals. Concentrates. National Products, 2510 S.E. Clinton, Portland 2, Oregon.

WANTED! Direct from factory to customer salesmen for guaranteed shoe line. Unusual factory fitting service. $1.00-$3.00 advance commissions, Bonuses, Experience unnecessary. Free starting outfit. Mench Shoes, 14B Brockton, Mass.

SELL New-Used clothing from home, auto, store. Men's suits $1.25; Leather Jackets 85c; Overcoats 56c; Dresses 18c; Ladies' coats 38c. Other Bargains. Catalog Free. National Mail Order, 1219T So. Jefferson, Chicago 7.

SELL Calendars Now. Be the first in your district. Good sideline or full time. Every business wants them. Few calendar salesmen are on the road now which means more sales for you. Fleming Calendar Co., 6539 Cottage Grove, Chicago 37.

NUSILVER Plating Liquid. Apply with cloth. Renews Silverware. Silverplates brass, copper. Easy seller. NuSilver, 508-10PSA New York St., Aurora, Illinois.

"CLEAN Dry" Clothes Brush. Chemically treated. Cleans clothes while brushing. Lightning seller. Samples sent on trial. Kristee 135, Akron, Ohio.

ADVERTISING book matches—Cash in on big demand—sell Union Label matches. Cuts for all businesses and political parties—Free powerhouse selling kit—low prices—protection guaranteed on repeat orders—Cash commissions. Superior Match Co., Dept. P-109, 7530 Greenwood, Chicago.

POPULAR SCIENCE OPPORTUNITIES

GOLD lacquered Window Sign Letters. Large Sizes Penny Each. New Foils. Absolutely Beautiful. Free Samples. Atlas, 544 W. 79th, Chicago 20.

AMAZING offer—$40 is yours for selling only 50 boxes Christmas cards. Also 50 and 25 for $1.00 with or without name. Free samples. Other boxes on approval, including entirely new, different deluxe assortment with feature television card. Cute plastic assortments. Write today. It costs nothing to try. Cheerful Card Co., 982 White Plains, New York.

AT last! Something new and sensational in Christmas Cards. Show Gorgeous Satins, Velours and Plastics never before offered. Gets Easy orders Fast! Pays Big Profits. Free Samples of Christmas Cards With Name 50 for $1. Imprinted Stationery, Floral Charmettes, Napkins, 50 other assortments 60c to $1.25. Samples on approval. Write. Puro Co., 2801 Locust, Dept. 941-M, St. Louis, Mo.

MAKE money easily. New spare time plan. Up to 100% profit. No experience. Show unusual Christmas, Everyday card assortments, Plastics, Gleam and Glo, Kiddies Cards, Wrappings, Attractive Gift items. Bonus. Special offers. Send today for free samples 30 different Christmas cards with name, 50 for $1.00 up. Stationery, Coasters, Thomas Terry Studios, 102 Union Ave., Westfield, Mass.

FREE Nylons given if Kendex hosiery runs or snags. World's only women's hosiery sold with written guarantee amazing everybody. Mere words could not express unbelievable money making opportunity. Fantastic earnings become reality. Armstrong earned $202 in 9 days. Watkins sent 92 orders in one day. Imagine replacing hosiery free regardless of cause—whether use or abuse! Truly sales dynamite for terrific profits. Even if you never sold before, three magic words: "Guaranteed Against Everything" will open doors for you—make women listen and your money in your pocket. Nationally advertised in Life, Ladies Home Journal, Saturday Evening Post, McCalls and Woman's Home Companion. Awarded Seal of Approval by Good Housekeeping. 75 million readers will see Kendex advertising to help you make quick sales and big money. Complete line from sheerest 15 denier 51 gauge to heavy 70 denier service. Sizes $8\frac{1}{2}$ to $11\frac{1}{2}$; lengths 28 to 35 inches; latest fashion colors plus white; full fashioned seamed and seamless. No competition because Kendex nylons are not sold in stores. Also complete line men's hosiery actually guaranteed for one full year or replaced free. Nothing like this anywhere. Includes rayon, nylon, lisle, wool, cotton, mixtures, etc. All styles, patterns, colors, prices to please everybody. 200,000 pairs constantly in stock for fast delivery. Thousands shipped daily. Over 30 years in business. You need no money or experience. Nothing to pay now or later. Just show free outfits. Write orders. We deliver and collect. Big advance cash plus huge bonus. Earn money spare or full time—exclusively or as side line. No restrictions. Become manager—appoint others to sell for you—earn steady income on their sales. Man or woman, young or old, experienced or beginner, you can make money and friends writing orders. Everything you need is furnished free, including sales books in color, samples of hosiery materials etc. Simply write your name and address on postcard and make money next week with money-making outfits sent free and prepaid. No obligation. Kendex Company, Babylon 14, New York.

NYLON, Poplin, Rayon Uniforms, white and colors. Immediate Delivery. Immediate Profits. Sell to Doctors, Dentists, Nurses, Waitresses, Beauticians, Housewives. Free Sales Kit. Superior Fabrics, Dept. A10, 3936 Market St., Phila. 4, Pa.

BIG Bargains for Big profits. Over 100 sensational values. Men's used suits $2, pants 35c, topcoats $1.25, overcoats $2, shoes 20c. Experience unnecessary. Free wholesale catalog. Superior, 1250-B Jefferson, Chicago 7.

NEW "Sponge" Dish Cloth. Replaces messy dishrags. Banishes dishwashing drudgery. Lightning seller. Samples sent on trial. Kristee 136, Akron, Ohio.

SELL Big Money-Maker to men and Women. Easy handwork makes fast-selling useful articles. Sample free. Sunmade Company, Brockton 64, Mass.

BIG extra income! Sell friends nylon hosiery, lingerie, blouses. Values supreme! Free sample displays. Christmas, Everyday greeting cards, gift wraps, Christmas samples on approval. Special outfit offers. Wear Wright, 1709 Arch St., Dept. B., Philadelphia, Pennsylvania.

OWN Your Own Business. Sell Men's Neckwear full or spare-time. Low investment, big profits. Send $1.00, receive two Sample ties plus free catalogue, color portfolio, selling plan. Radio City Neckwear, Dept. P.S. 2, 112 W. 50th, N. Y. C.

SELL ultra-blue stock signs to stores. 1000 slogans, comedy, general, religious. "7x11" cost 6c—Sells 35c—Make money. 15 samples Ultra-blue signs "7x11"—$1.00 postpaid. L. Lowy, 8 West Broadway, Dept. 499, New York City 7.

BUY thousands of nationally advertised products direct from manufacturers and distributors. Write for "Buy Direct and Save", Service Publishing, 218-B Investment Bldg., Pittsburgh 22, Pa.

HOTTEST 39c Item on the market. National Sales & Service, Greenville, Pa.

SCHOOL Seniors!!! Your postal will bring our wonder, Kwick-Sell Cardalog of popular Graduation Name Cards. Biggest profits!!! Only firm giving free souvenir chest and Card Case. Don't miss out! Hurry that postal!!! Craftcards, Box 235 (M), Pittsburgh 30, Pennsylvania.

WHERE To Buy 800,000 Articles Wholesale! Details Free. Schibani, Box 1576-S, Birmingham 1, Ala.

SPARE Minutes bring dollars selling this new burn ointment. Free details. Clover Products, 11860S Mississippi, Los Angeles 25.

63 HIGHGRADE SALESMEN

BIG Money Taking Orders: Shirts, Ties, Sox, Pants, Jackets, Sweaters, Shoes, Uniforms, etc. Sales equipment free. Experience unnecessary. Nimrod, 4922-AV Lincoln, Chicago.

LOOK Here! Wanted—Men and women to start in business on credit. Sell some 200 farm-home Products. Thousands our Dealers now make quick sales, big profits. For particulars write Rawleigh's, Dept. J-192-PSC, Freeport, Ill.

SALESMEN. Earn $100.00 weekly, selling only six pair shoes daily. Commission and bonus. Wide variety for men, women, children. No investment. Experience unnecessary. Free catalog. Tanners Shoes, 515 Boston, Mass.

SALESMEN—Put yourself in line for big money, real future. Keep stores supplied with 5c-10c to $1 counter goods. Nationally advertised. Top profits for you and merchants. Liberal deals boost sales. Sideline or full time. World's Products, Dept. 83-Y, Spencer, Ind.

DIGNIFIED Selling . . . Commissions in Advance! Perfo—the leader in its field—has full line of custom-built rubber mats with inlaid names, numers and trademarks. Big commissions paid in advance to hundreds of successful representatives. Write for details on this year 'round business today. Perfo Mat & Rubber Company Inc., PS-1, 281 Fifth Avenue, New York 16, New York.

UP to $12.00 in a day and tailored suit for yourself without paying one cent. Write for plan. W. Z. Gibson, Dept. X-521, 500 S. Throop, Chicago 7, Illinois.

67 EDUCATIONAL AND INSTRUCTION

BOOKKEEPERS! Increase your earnings! Operate your own simplified "Dollar-A-Week" Bookkeeping and Tax Service. Full or Spare time. Details Free. No obligation. Ellis, Box 203, Cedar Grove, North Carolina.

EXPORT! Learn at home from established World Trader. Big paying positions. Your own profitable world-wide business by mail order without capital; or travel abroad. Experience unnecessary. Free booklet. Mellinger, 210 W. Los Angeles 24, California.

MATHEMATICS. Individualized instruction. NCS, Box 27, St. Johns Station, Brooklyn 13, New York.

DO you want Success—Self-Confidence—More Money? You have the ability—Home Study Course develops your mental powers quickly, easily. Results proven. Write for "Free Personality Chart" and full details. Self-Help Foundation, 746-P South Lake St., Los Angeles 5, Calif.

BE A real estate broker through home study or classroom instruction. Write for free book. Approved for veterans. Weaver School of Real Estate, 15 E. Pershing Rd., Box CP-8, Kansas City 8, Mo.

PREPARE Now for permanent, big pay Diesel jobs. Write for Free information about our approved, easy-to-understand Diesel Training Course. Covers all phases. Learn as you earn. Placement advisory service Free. Write today! Interstate Training Service, Dept. 2 K, Portland 13, Oregon.

STUTTERING or Stammering Corrected at Home. Amazingly successful method. Send for free literature showing how you, too, may overcome stuttering at home. The Atheneum, PS-102, 1714 Chestnut, St. Louis 3, Mo.

HOW You Can Get A Better Job. Send for free information. Stanley Research, P. O. Box 2151, San Francisco, California.

PIANO Tuning Pays. Learn this profitable profession at home. Our Tonometer and mechanical aids make learning easy. No knowledge music necessary. Diploma granted. Largest and oldest school—51st year. G. I. Approved. Write for booklet. Niles Bryant School, 77 Bryant Bldg., Washington 16, D. C.

BECOME a Doctor of Psychology or Metaphysics. Teach secret of contentment, happiness. Win degree of PsD. or MsD. Solve mental worries. Free book. College of Universal Truth, 5153-K N. Clark, Chicago.

LEARN Auctioneering. Col. Nelson can teach you by mail or resident classes. Sample lesson Free. Nelson Auction School, Renville, Minnesota.

INEXPENSIVE Manual teaches air conditioning. Write Don Nelson, Warner Robins 3, Georgia.

USED Correspondence courses bought, sold, rented. Literature free. Baker, 5509-A Winthrop, Chicago 40.

GOOD salesmen command good pay. To learn the "know how", send for Tom Burt's course in salesmanship. Only $5.00 for six weekly lessons. Invaluable to any one entering sales field and to salesmen in a rut. The information, counsel and constructive ideas contained in this course make it worth many times its cost. Place $5.00 in envelope now with your name and address and send to Mead Publishing Co., 404 Halliburton Bldg., 1709 West 8th, Los Angeles 14, Calif. First lesson "You and the Field" sent immediately.

BETTER Jobs—More Pay. Learn Beautiful Handwriting. 100% improvement few days. Easy method complete $1.00. Bradley, Box 559-B, Linwood, Pa.

MAKE Up To $35-$45 Week as a Trained Practical Nurse! Learn quickly at home. Booklet free. Chicago School of Nursing, Dept. M-10, Chicago.

USED Correspondence Courses and Educational Books Bought, Sold, Rented; Catalog Free. Educational Exchange, Summerville, Ga.

MEDICAL Laboratory Technicians in great demand. We train you in your own home. Catalogue free. Imperial Technical Institute, Box 973-B, Austin, Texas.

FALL Classes in Air Conditioning, Refrigeration Heating and Heat Pump Engineering are forming Now. Write for free information. Detroit Air Conditioning Institute, Dept. A, 4125 Grand River, Detroit, Michigan.

PHOTOGRAPHIC mind with Supermemory, write Thor Books, S-10 Box 1210, Chicago.

HOME Study Courses. Chiro-Deo-Therapy, Drugless Healing Certificates, Diplomas, Degrees. Western University, 911-13 West University Ave, San Diego 3, Calif.

69 CONTESTS

WIN Cash, Cars In Prize Contests! Write for copy filled with current contests, winning hints and tips. Send only 25c. Wright Contest Digest, Dept. 20-K, P. O. Box 2266, St. Louis 9, Missouri.

POPULAR SCIENCE OPPORTUNITIES

HITCH Your Wagon to a ConteStar! Send 3c stamp. National Contest Bulletin, Box 2685-C. Miami 31, Fla.

70 LANGUAGE OUTFITS

LINGUAPHONE Makes Languages Easy. At home learn to speak Spanish, Portuguese, Italian, French, German, Russian, by quick, easy Linguaphone conversational method. Save time, work, money. Linguaphone Correspondence Courses are available to veterans under G.I. Bill of Rights. Send for free book. State if G.I. Linguaphone Institute, 54 RCA Bldg., New York 20, N. Y.

72 AUTHORS SERVICE

I WANT New Writers to cash checks of $1 to $100 offered daily. The easiest way to write for pay. No previous experience necessary. Free Details. Saunders M. Cummings, 468-15 Independence Bldg., Colorado Springs, Colo.

73 BUSINESS SERVICE

SUCCESSFUL letters developed which pull results. P.O. Box 1067, San Francisco.

74 CARTOONING, SIGN PAINTING, DRAWING AIDS

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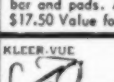

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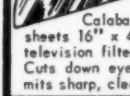

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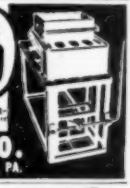

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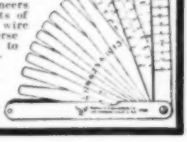

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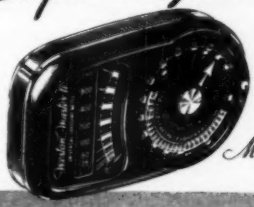

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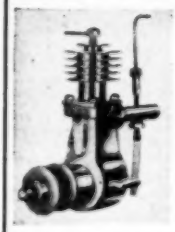

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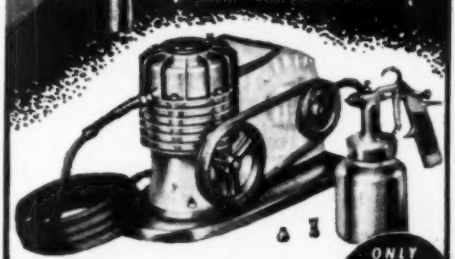

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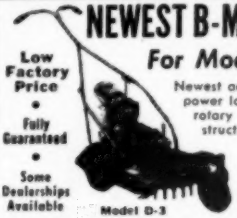

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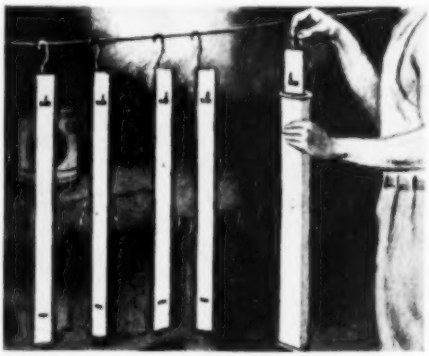
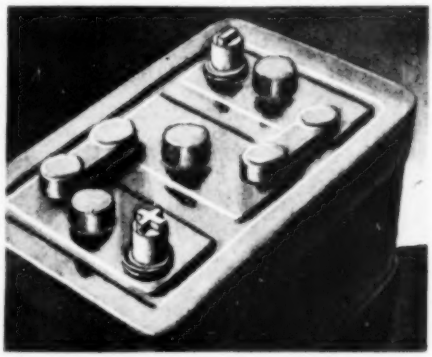


Dipping vats for painting Venetian blinds. These could be of various depths to accommodate different length slats. One dip would paint each slat and they could be hung up to dry.—*V. Hoffman, Springfield Gardens, N. Y.*



Raised positive and negative symbols on auto storage batteries. Then it would be simple to identify the poles even if the battery were dirty and the poles corroded or marred by tools.—*Harold Myers, Kennewick, Wash.*

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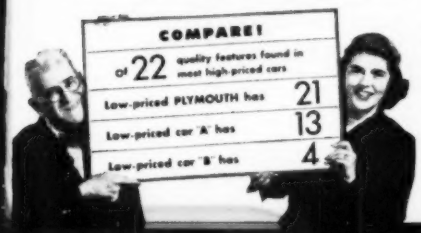

Check Plymouth value against other cars. Not only for **comfort,** but for **performance,** for **safety,** for **all** features! Drive Plymouth. Compare it on the road. And see the new Quality Chart at your dealer's; a condensed version at left.

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I'd like to see them make . . .

Plastic insulation. After you spliced two wires, such a liquid could be painted over the splice. When dry, it would be neater and less bulky than a wrapping of tape on the wires.—*Ray Sherman, Belleville, Wis.*

Offset posts for electric fences. Weeds and grass grow up and sometimes cause shorts. With the posts offset, you could run a mower beneath the wire or cut the weeds with a scythe.—*Archie Casebolt, Brooklyn, Iowa.*

One handle for broom and mop sets. The end of the handle could be threaded to fit various brooms and mops. Such an arrangement would be a space saver in most storage closets.—*Sula Butler, Los Angeles.*

RCA scientists develop new *direct-reading* Loran instrument which simplifies problems of navigation.

The **homing pigeon** *goes to sea*

Now science gives the navigator an improved "homing pigeon instinct," a way in which—without checking sun or stars—he can head directly home.

Already thoroughly proved, *Loran equipment* has been simplified through RCA research and engineering, so that almost anyone can learn to use it in a few minutes. Free of human error, readings appear *directly* on the instrument. A quick check gives the ship's position.

Brain of the new Loran is a circuit developed at RCA Laboratories which splits seconds into millions of parts—accurately measures the difference in the time it takes a pair of radio signals to travel from shore to ship.

Given this information, the Loran navigator, hundreds of miles from shore, can determine his position quickly and accurately. Loran's simplicity adapts it to every type of vessel from merchant ship to yacht. Manufactured by Radiomarine Corporation of America, a service of RCA, it is already being installed in U. S. Coast Guard rescue ships.

The meaning of RCA research

RCA's contribution to the development of the new direct-reading Loran is another example of the continued leadership in science and engineering which adds *value beyond price to* any product or service of RCA.

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The newest developments in television, radio, and electronics can be seen in action at RCA Exhibition Hall, 36 West 49th St., N. Y. Admission is free. Radio Corporation of America, RCA Building, Radio City, N. Y. 20.

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A special "tracer" current, sent over the faulty wires, generates a magnetic field. Held against the sheath, an exploring coil picks up the distinctive tracer signal and sends it through an amplifier on the man's belt to headphones. A change in signal strength along the cable tells the exact location of the "fault."

Compact, light, simple to use, this test set makes it easier for repairmen to keep your line in order. It is another example of how Bell Laboratories research helps make Bell Telephone service the most dependable in the world.

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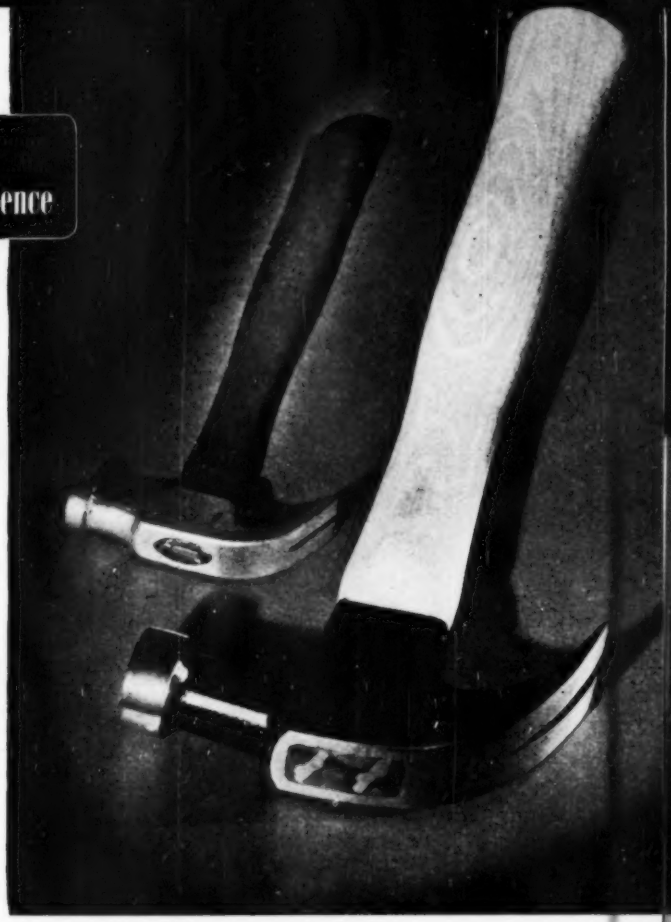
Tomorrow's Workmen Need Better Tools



THE old saw that "a good workman never complains of his tools" is too often used to excuse poor tools. It really means that a good workman won't put up with bad tools that make his job harder. So he begins a job by working on the tools before he starts on the work.

Only an expert, in fact, can make do with poor tools if he must. *A beginner needs the best.*

Yet, every day, some father or big brother tosses an eager youngster a bent screwdriver or a battered hammer and thinks he has done his duty.

Perhaps the worst offenders are the parents and doting uncles who pay good money for boy-size "kits" that even an expert would curse.

Saws of trash steel with "teeth" that hardly cut soap. Hammers with soft heads that come off on the first try—and handles of assembled splinters. Edged tools sharp enough only to cut young fingers.

The excuse for this slick junk is that it comes in small sizes—and real tools to fit small hands are hard to find.

This is a challenge to the makers of those good tools of which no good workman complains. And they have a bigger stake in the problem than fitting bigger hands. For it will be a sad day for this country when boys stop wanting to make something for themselves, of themselves, and by themselves.

The manufacturers have a double responsibility to make and merchandise tools for beginners. First quality tools, for young hands, that can wear the proud old labels. That can drive the junk back to the scrap pile.

If there are to be good workmen tomorrow, they must have good tools today.

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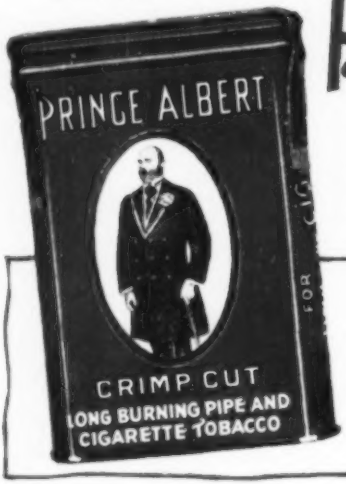

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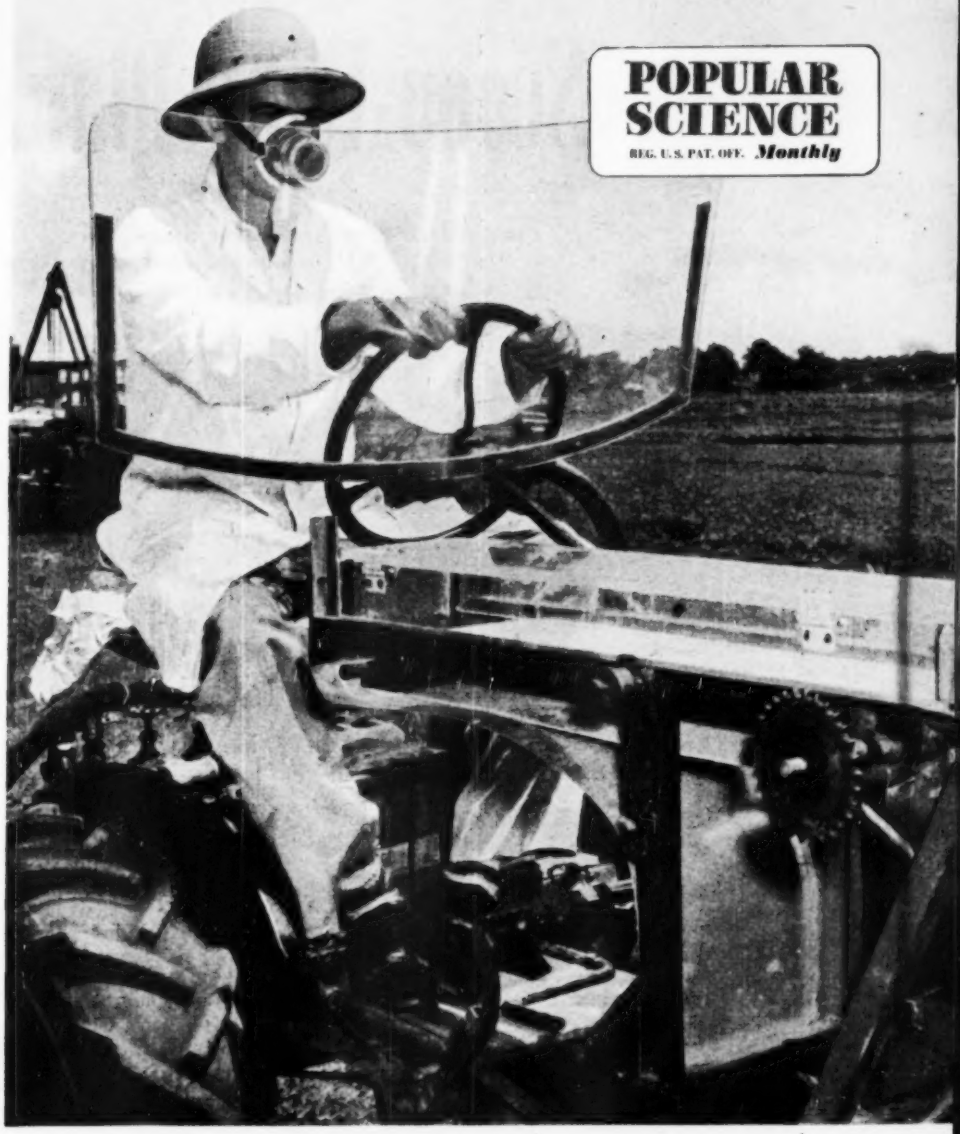

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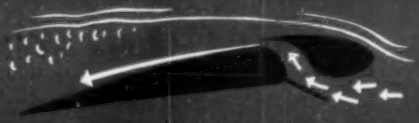
Scoop-Wing Plane

Paraplane's radical wing-with-the-holes works like this—

1 **Doors in wing surface,** hinged at rear, open slightly for take-off. Scooped air flows backward through jets to control boundary layer (see text), aid lift. But in normal flight . . .



Leaps off Lawn

Cover by Reynold Brown

Your yard can be your airport with two new planes that land or take off in a few feet.

By Devon Francis

PS photos by W. W. Morris and Hubert Luckett

FOR a quarter of a century they have been talking about designing personal airplanes capable of landing on and taking off from a piece of real estate no bigger than a tennis court. Small airplanes, airmen argued, had to do that if they were going to have any utility. Hundreds, if not thousands, of false starts have been made on that kind of a flying machine.

Now, at long last, it looks as though they are getting somewhere.

Two new experimental planes promise to fill the bill. Both have "fixed" wings, like other airplanes. Both would let their owners fly to and from any place boasting a sizable lawn, not just between airports. Neither has the helicopter's costliness or its complexity.

One, called the Helioplane® (to liken it to a helicopter in performance), lands in half the width of a city lot, against a 25-m.p.h. wind. It takes off, in the same wind, in 50 feet. It requires about twice that when there's no wind.

The other plane is called the Paraplane® (to liken it to a parachute in performance). Its designer expects the production version will at least equal the Helioplane.

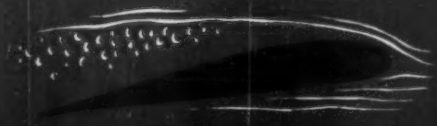
By contrast, present-day standard lightplanes cruising at 100 miles an hour or better require several hundred feet for landing in still air and somewhat more space for taking off—unless there is a crackerjack pilot at the controls.

One of these two new planes was built by a couple of college professors, the other by the son of the man who invented the ice-cream cone. And, weirdly, the ice-cream cone had more than a little to do with the design of that second airplane.

Except in performance, and the fact that both have been built on a financial shoestring, the two planes have little in common. One looks like almost any other lightplane. The other resembles a vest-pocket edition of a gull-wing Navy fighter. But both have fantastic angles of climb and descent. And both are as well-behaved at low speeds as a hobbled lamb.

The Paraplane (which is pictured on the cover of this issue of POPULAR SCIENCE) has the more romantic background. The inventor, Edward M. Lanier, and his father, Edward H. Lanier, both unredeemed skeptics in lightplane design, experi-

2 Doors are fully closed to reduce drag to minimum, convert Paraplane into conventional machine. Pilot flies right up to lip of landing field before closing throttle, cranking doors...



3 Open, as shown here. This creates high air resistance to slow speed, jets air back into boundary layer, and creates low-pressure area in wing top to cushion descent for slow landing.

Batlike configuration plus gull-wing dihedral helps Paraplane's lift, aids stability. At root, wing chord is 10 ft. Wing loading is 12 lb. compared with the usual lightplane's 7 or 8 lb.

Pencil points to bank of jets through which air streams from scoops in front. Maximum depression of doors, which cover third of wing area, varies from 8 in. inboard to 1½ in. at tip.

Scoops take in air, also change contour of wing's lower surface, boosting lift. Their maximum opening ranges from 6 in. to 2 in. Wing area is small—100 sq. ft., about half usual area.

Control for scoops and doors is hidden at right in experimental cockpit. Power is from Continental 90-hp., opposed-cylinder engine. It turns ordinary propeller at 2,300 r.p.m. for cruising.

mented for years with odd-looking flying machines. They got the idea for a cell of low-density air in the top of the wing right out of the ice-cream cone that the elder Lanier invented.

Ruminating on the cone, the Laniers dropped weighted paper cups from the window of a 12-story building. Some of the cups were open at the top, some were sealed. The sealed cups beat the open cups to the ground.

Here's why. A low-pressure area forms inside an open-top cup on its way to the ground. It falls too fast for the surrounding air to flow inside and maintain normal density. Thus the low-pressure area slows the cup's fall by creating added lift.

Lanier figured he could get the same kind of added lift by building big holes in the tops of his Paraplane's wings. The holes create a greater-than-normal low-pressure area—a mild semi-vacuum—on the wing surface while the plane is descending. The reason for that is the same reason that most airplane wings are bulbous in front. The air has to speed up to get over the bulge, and when it speeds up it gets thinner. An airplane flies only because the air speeding across the top of the wing is thinner than normal. The air below the wing keeps trying to push up into this semi-vacuum. That creates lift. In this way, some three-fifths of the lift generated by a wing in flight comes from the top surface. The rest results from the "planing" effect of the bottom of the wing on the air—the same thing that makes a flat stone skip along the surface of water.

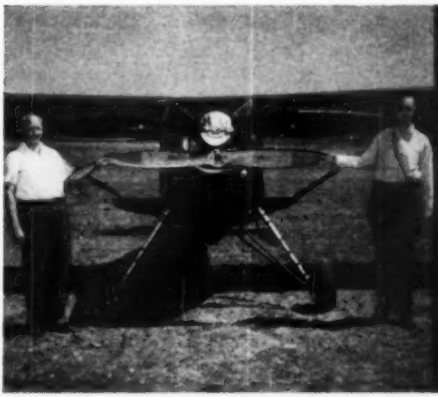
Thus the Paraplane uses its wing holes to supplement ordinary lift. The pilot

creates the holes merely by pushing a lever in the cockpit. The lever opens doors in the tops of the wings. By releasing it, he can make the wing tops again as smooth as those of a conventional airplane.

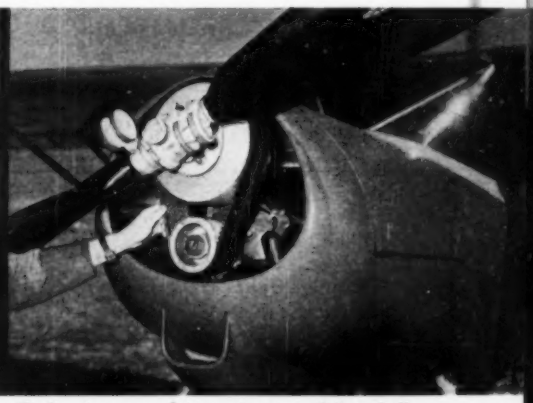
That's only half the trick Lanier performs with his wing. Some airplanes have slots on the leading edges of their wings, amounting to a secondary leading edge. These slots control a very thin layer of air flowing close to the wing surface. Known as the boundary layer, this air must wash the wing smoothly for lift to result. But at low speed, or when the wing is tilted up sharply, the boundary layer tends to separate from the wing too soon and "burble"—thereby sacrificing lift and increasing drag. It is the boundary layer that gets out of control when a "stall" develops. Slots help prevent stalls. Air streams through them, washes back over the wing, and re-establishes part of the lost lift.

Lanier attacks the problem of boundary-layer control—but in a different way. Instead of slots, he has scoops just under the leading edge. They serve the same function. By making the scoops big and their outlets on the wing top mere slits, he gets a venturi effect. Compressed by the restricted space, the escaping air leaves faster than it entered. This helps control the obstreperous boundary layer and provides the Paraplane with added lift.

Second high-performance ship, Helioplane, takes off at spectacular climb angle without danger of stalling. Plane's 29-foot span is normal, but length is 4 ft. greater as aid to stability. Wing is from standard Piper Vagabond with 5-ft.-3-in. chord. Goodyear landing gear casters for crosswinds. Plane was built for two college professors by Wiggins Airways' Joseph Garside.



Big 9-foot Aeromatic propeller (PS, May, '48, p. 164) dwarfs standard 6-foot prop. Performance depends on area covered, goes up as square of length. Engine is fuel-injection Continental.



Reduction gear lets engine turn 2.3 to 1. Prop turns 1,200 revs maximum and 1,080 at cruise. Inventors stress that the minimum speed, unlike most planes', is above wing's stall point.

Full-span automatic slots give Helioplane boundary-layer control at high angles of wing attack. Pilot retains full control at 30°—twice the angle of climb that ordinary wing will permit.

Flaps and spoilers also contribute to extraordinary control characteristics. Full-span flaps are also ailerons, responding to stick at any setting. For present, spoilers are experimental.

Innovation in Helioplane is lack of vents in cowling for escape of air taken in to cool engine. Instead, air is routed through exhaust pipe and into "hush-box," above, reducing noise level.

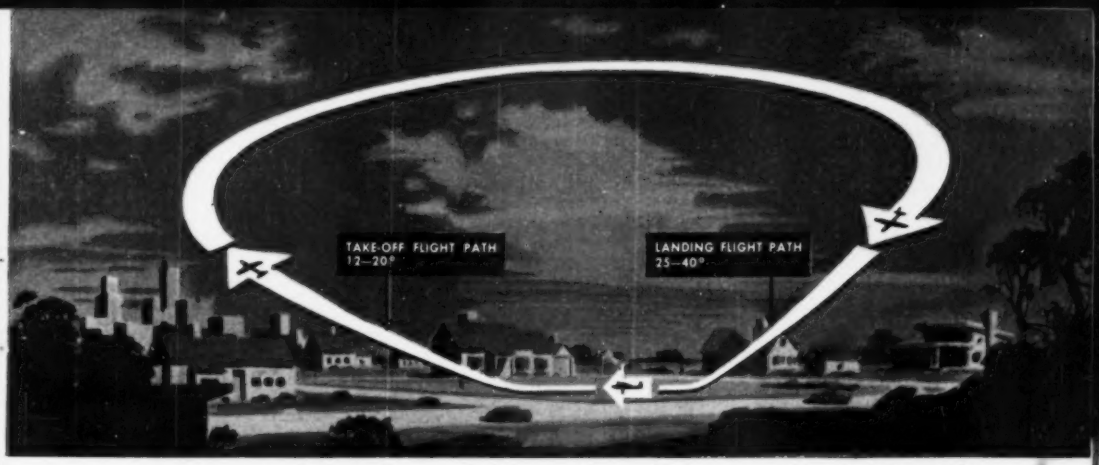
One of plane's neat problems was yaw at low speed—tendency to turn opposite to bank. This was remedied by splitting rudder. Bottom half is linked to ailerons, top half to rudder pedals.

So much for the Paraplane. The new Helioplane is something else again. Being flown at Norwood, Mass., it is the brainchild of Otto C. Koppen, professor of aeronautical engineering at Massachusetts Institute of Technology, and Lynn L. Bollinger, former transport pilot who is now professor of business administration in the Harvard Business School. On Professor Koppen's own statement, this airplane incorporates nothing new in lightplane design. What it does do, however, is combine known principles of flight in a new way.

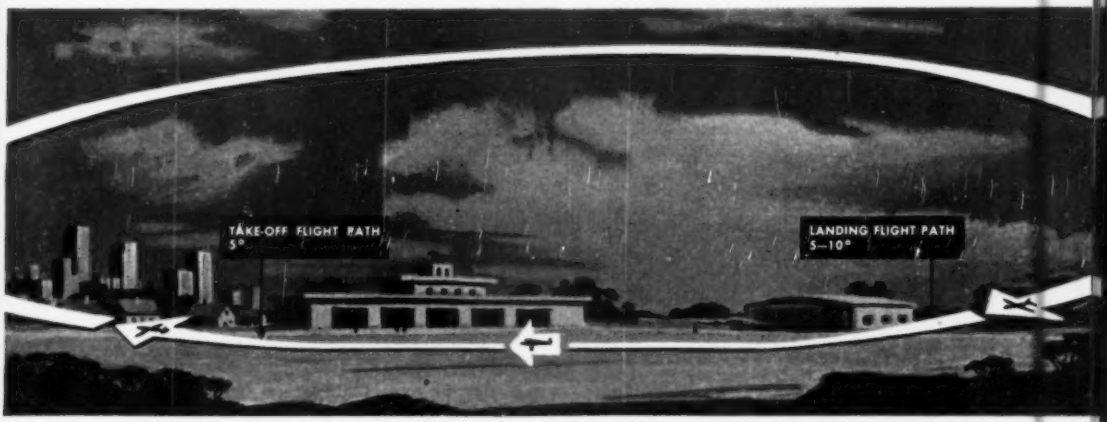
It has slots. It also has full-span flaps on the trailing edge of the wing. Flaps are no novelty; all transports have them. They momentarily change the shape of the wing, giving more lift for take-off, or high lift and added drag for landing.

The Helioplane also has spoilers, the gimmicks used on gliders to disturb the boundary layer and decrease lift for landings. The Helioplane's spoilers, unlike a glider's, respond not to a separate control but instead to the control stick. They are being used experimentally for added lateral control at very low airspeeds. If a wind gust pushes a wing up, the spoilers open up on that side of the plane to kill part of the lift.

But the Helioplane's most unusual feature is a huge propeller geared down to turn at about half engine speed. The reason for that is based on the same fact that makes pilots of jet airplanes cautious about their airspeed in landing and taking off—a gas moving at high velocity doesn't provide much thrust at low aircraft speeds. The gas displaces too much air too fast.



Steep descent and climb, low speed of new experimental planes make good-sized lawn an airport. Even so, several hundred feet of "free-way"—unobstructed area—must be available.



Present-day lightplanes, unlike Paraplane and Helioplane, lack utility because they require low approaches and several hundred feet of take-off-landing space when there is no wind to help.

Among attempts to produce useful personal aircraft have been Curtiss Tanager (left), winner of 1929's 100,000 Guggenheim contest, Ercoupe (center), curved-wing job (right).

The reverse is also true: a big volume of air displaced at low velocity provides a lot of push at low aircraft speeds. The average lightplane's propeller threshes the air with a considerable loss of thrust until flying speed is attained. By contrast, the Helioplane's big, slow propeller gives ample, instantaneous thrust right away.

The giant prop helps another way, too. Any schoolboy knows that an airplane's wings derive additional lift from the backward "prop wash." That's why propellers are mounted as they are on transports. The Helioplane's propeller covers much more wing area with backwash than does that of the conventional lightplane.

It is not abusing the meaning of the word to say that both the Paraplane and the Helioplane perform sensationally. I watched both of them fly. The Helioplane will float along level without losing altitude at less than 30 miles an hour. In its present form the Paraplane will do the same thing at something above 30 miles an hour.

The Paraplane, based at Marlton-Medford airport in western New Jersey, took off with a run of less than 200 feet, against a choppy wind of perhaps 20 m.p.h. It landed with a run of about 150 feet. In itself, that wasn't too impressive. I've done that in a Piper J-3. The Helioplane performed a lot better against a 25-mile wind.

Paraplane Climbs Like Rocket

What was impressive was the Paraplane's rocketlike rate of climb and sharp angle of descent. Moreover, Lanier says that his experimental airplane is 225 pounds overweight, beefed up for its tests, and that his production job will land in less than 100 feet and take off in 100 feet.

Both airplanes are described as spinproof. Each will cruise at 100 to 110 miles an hour.

As a run-of-the-mill lightplane pilot, I have three criticisms to make of the Helioplane, one of the Paraplane. The Helioplane's owners are touchy on the subject of the meager ground clearance of their propeller. They can well be. Because of the size of the prop, the machine must be taken off and landed tail-low to prevent damage to it. That fault could be mended with a slow-turning three- or four-bladed prop. Second, because the Helioplane is so eager to fly, I suspect that it would prove difficult to handle on the ground in a high wind unless it were fitted with a tricycle landing gear to provide the wing with a slightly negative angle of incidence and kill its lift. And finally, I wonder whether the high efficiency of the plane's engine-propeller combination at low airspeeds is only at the sacrifice of efficiency at cruising speeds.

The Paraplane is outside my experience. But it struck me as providing too little visibility for the pilot in the landing maneuver. In landing a conventional lightplane, the nose is down on final approach, giving the pilot a good view. But the Paraplane must be nose-level or nose-high throughout the final approach to get the benefit of the vacuum-generating wing. The pilot sits high and forward in the ship, in fact, for just that reason. Even so, his visibility, vital to safe flying, must suffer.

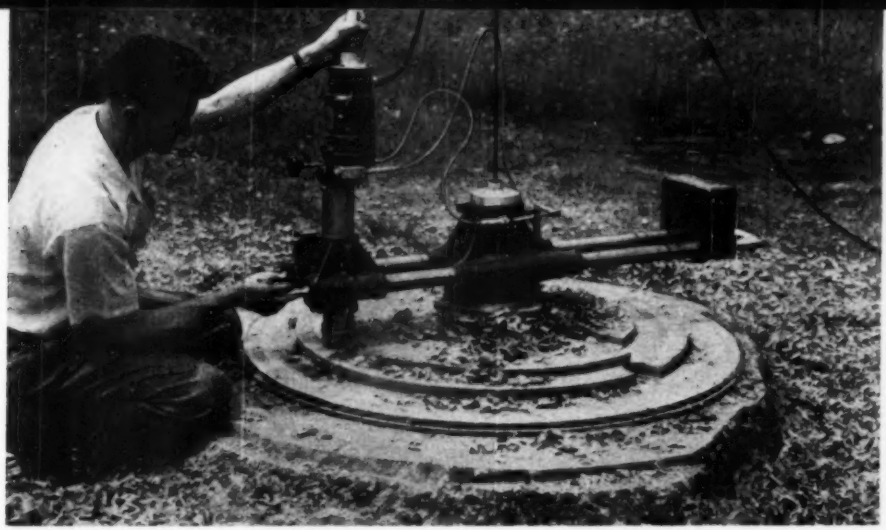
New Designs Promise Wider Market

Both the Helioplane and the Paraplane, put into production, unquestionably would boost the use of personal aircraft. The record of lightplane ownership in the U. S. is a glum one. After a brand-new pilot with his brand-new airplane exultingly has taken his family and friends for a ride, he finds himself wondering what to do next. He can't drive his mount to Aunt Martha's across town. He can't use it to go to the grocery store. Every time he lands at an airport he must find motor transportation into town. The general rule has been that after a year or so he sells his plane in disgust.

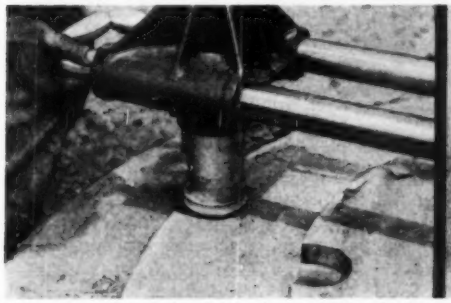
Lightplanes that will get into and out of tight places—that will fly off your lawn—will have a much greater utility. They will give more for the invested dollar. Lanier even proposes to put folding wings on his craft so it can be hangared in the family garage. Lightplanes probably never will whip the weather bugaboo, the main bar to all-around usefulness, but the new experimental designs should release them from the restrictions of the airport. END

How Many Colors Do You See?

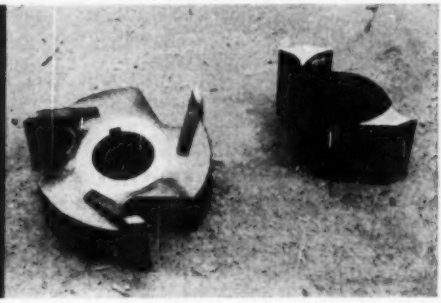
SEVENTEEN thousand distinct colors are visible when observations are made with a precise optical instrument. To this figure Dr. David L. MacAdam, of the Kodak Research Laboratories, adds the fact that when large pieces of colored paper are observed with the naked eye, roughly 50 per cent more colors can be distinguished than by the finest optical means. Dr. MacAdam estimates that there are about 250 distinguishable colors in the spectrum, plus 10,000 distinguishable tints of spectral colors and 7,000 non-spectral colors, such as purple.



Router bites away at stump 68 inches across. Block at right of machine is counterweight.



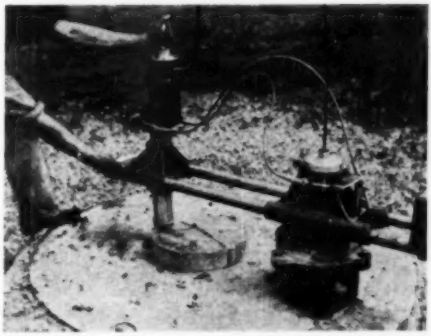
Close-up above shows steel cutter head, 3¼ inches in diameter, ready to tear into the stump. Whirling at 5,200 r.p.m., it chips away an area 2½ inches wide and 1¼ inches deep.



Stump remover has two types of steel cutters. The three-bladed one, left above, is used on smooth-grained wood; the two-bladed one, right, chews right through hard, knotty areas.

Steel Beaver Chews Out Stumps

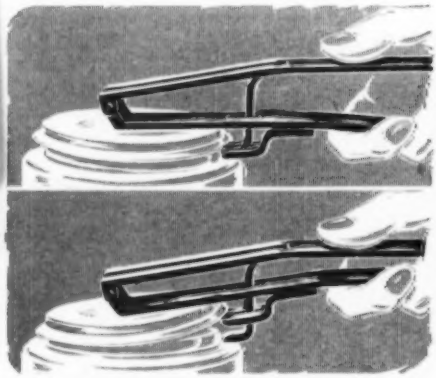
THE steel "teeth" of this machine can rout out in 10 hours a big tree stump that would take you 10 days to chop out by hand. Fastened to the center of a stump, the machine is rotated by hand while a revolving cutter chews away the wood. After a cut is made all around the stump, the operator unlocks a radial brake and pushes twin bars, on which the motor assembly is mounted, toward the tree center for another rotation. A spindle, with a six-inch stroke, permits adjustment of the cutter to an uneven surface. Powered by a 2½-hp. electric motor from a portable generator, the Stump Beaver® routs out a stump to any depth. Invented by Walter S. Spott, of Verona, N. J., it is still in the experimental stage. END



To cut down the stump's center part, the machine is remounted at the side of the stump on an adapter platform, which raises the device up to the surface of the pole for cutting.

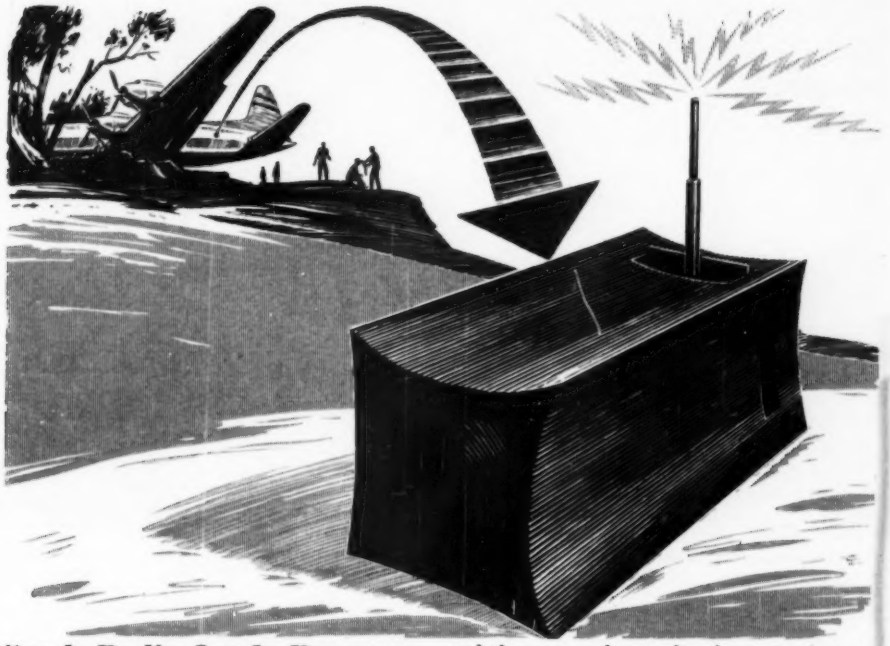
New Ideas from the Inventors

Car Trunk Packs Clothes Flat. Auto travelers wouldn't have to pack their clothes in suitcases or hang them up inside the car with this special compartment. A shallow tray with its own door built into the lid of the regular luggage compartment, it permits suits and dresses to be carried flat and unfolded so they won't wrinkle. Patented by S. W. Ford, of Dayton, O., it takes little space, leaves the usual room for luggage.

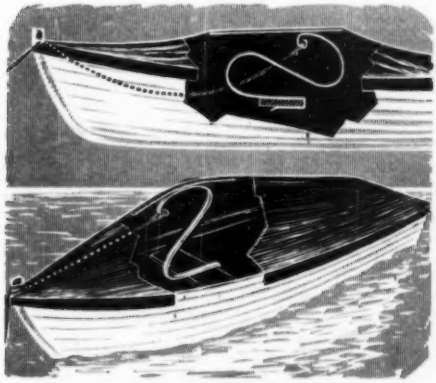


Opener Pries Off Jar Tops. Easier opening of jars with pressure caps is the object of the opener invented by N. Eastman, of New York City. A fork on the lower handle hooks under the lid's edge. When lifted up, this pries off the cap while a foot extending down from the upper handle rests against the jar's shoulder for leverage.

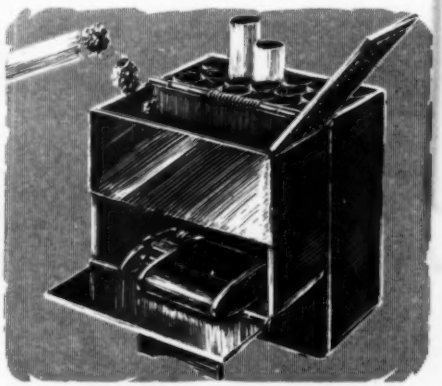
Tube Vents Baby's Bottle. Babies would get milk, not air, out of this bottle. When a vacuum begins to form, outside pressure forces in air through a flexible tube in the bottom. A weighted collar keeps the tube bent over to close it until the pressure builds up enough to straighten it out. The inventor is R. M. Soper, of Tacoma, Wash.



Crash Radio Leads Rescuers. If an airplane crashes, this shock-mounted radio transmitter is designed to be ejected by an explosive charge set off by the impact. Safely away, it then sends out distress signals to help rescuers locate the plane. A telescoping antenna, pivoted inside like a pendulum, automatically slides out of a slit in whichever side comes to rest on top. The inventor is C. J. Camp, of Palo Alto, Calif.



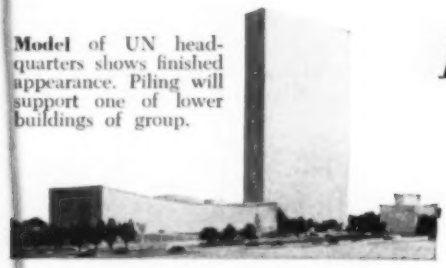
Spring Supports Boat Cover. Heavy boat tarpaulins could be put on easily with the S-shaped leaf spring patented by F. D. Burns, of Muskegon, Mich. The cover is put on loosely with the spring compressed. Pulling a rope tied to the top of the S forces the spring upright, tightening the tarpaulin and raising it up so water will run off.



Case Meets Smokers' Needs. In addition to holding a full pack of cigarettes, this novel container has a compartment for a lighter or matches and a built-in ash tray. When moistened with water, a strip of blotting paper on top of the ash-tray lid helps keep the tobacco from drying out. The inventor is V. Trinko, of Downers Grove, Ill.

1. After big mobile pile driver has been maneuvered into place on endless tracks, cable is attached to long steel pile, and rig swings it aloft, to stand on end for driving to bedrock.

2. Men scrambling up rig, to help guide pile, give idea of its comparative size. But even this big pile driver is far from largest of type, giants that have driven piles 194 feet in length.



Model of UN headquarters shows finished appearance. Piling will support one of lower buildings of group.

Big Hammers Speed Job of Pile Driving

By Alden P. Armagnac

PS photos by W. W. Morris

THERE'S more to driving a pile than brute force—it's an art that experts write whole books about. These pictures of how a big, modern pile driver does its job give you an idea of the skills involved.

Largest of several in action on the site of the United Nations' future New York City headquarters, this steam-hammer pile driver is sinking steel piles as underpinning for a low building of the group. The whole construction project is being carried out by leading contractors associated under the name of Fuller-Turner-Walsh-Slattery, Inc.

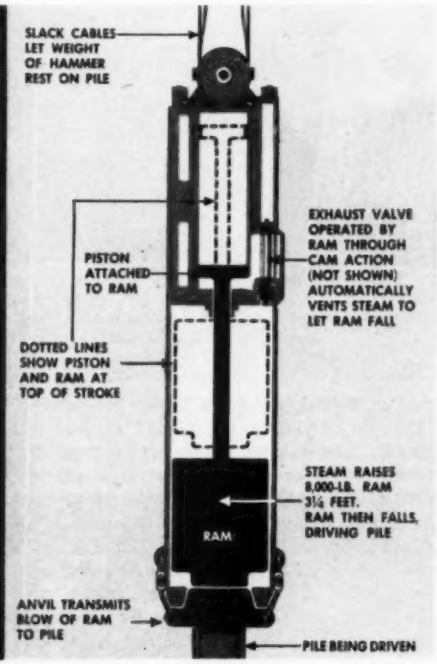
Steam-hammer pile drivers have almost entirely supplanted the old-fashioned drop-hammer kind, which hoisted an iron weight of a ton or so to the top of a derrick-like frame, and then dropped it on a pile. A steam-hammer rig is a simple form of steam engine, using a piston in a cylinder to raise the striking weight or ram. Drop hammers can deliver five to six blows a minute; steam hammers, 10 to 20 times as many, driving more piles a day with less damage to the piles and, through vibration, to nearby foundations and structures.

Single-acting steam hammers, like the one shown here, use a ram of 3,000 to 14,000 pounds that falls by gravity from the top of its approximately three-foot stroke. Double-acting steam hammers add steam pressure to force of gravity to propel the ram downward, permitting a lighter ram, a

3. Worker drops rock to check position of rig over right spot. Seen just above him, anvil of steam hammer is notched to fit and engage H-shaped end of pile that hammer will drive.

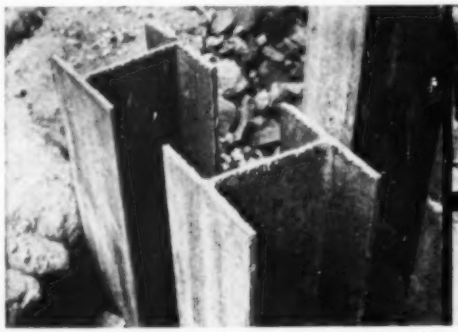
4. Pile now stands vertically on ground, ready to be driven. Whole weight of steam hammer rests on its top end. Hoisting cables of hammer are slack, and hammer will follow pile down.

5. Fifty-five clanging blows a minute from four-ton ram of steam-spouting hammer drive pile home. Rapid at first, progress gradually slows, ending when pile reaches bedrock.

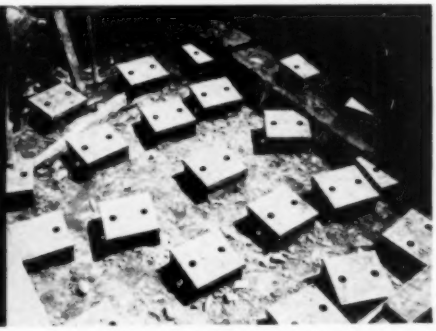


6. Inside view of steam hammer shows how piston raises ram, which trips exhaust valve and falls against anvil, driving pile. Operation is automatic so long as operator feeds steam.

7. Sunk to "refusal" or until they will go no farther, these piles have come to rest against bedrock, deep below the surface of the ground. Because of irregularities in the underlying rock strata, some piles are left projecting farther than others. All will be cut off evenly, before concrete is poured over them in the boxlike forms seen in the illustration above.



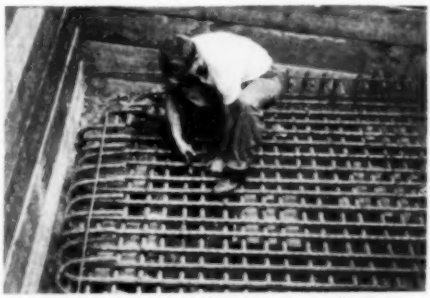
8. Trimmed off with cutting torch, ends of sunken piles clearly show their H-shaped cross section. Except for their uniform thickness throughout, they resemble structural girders.



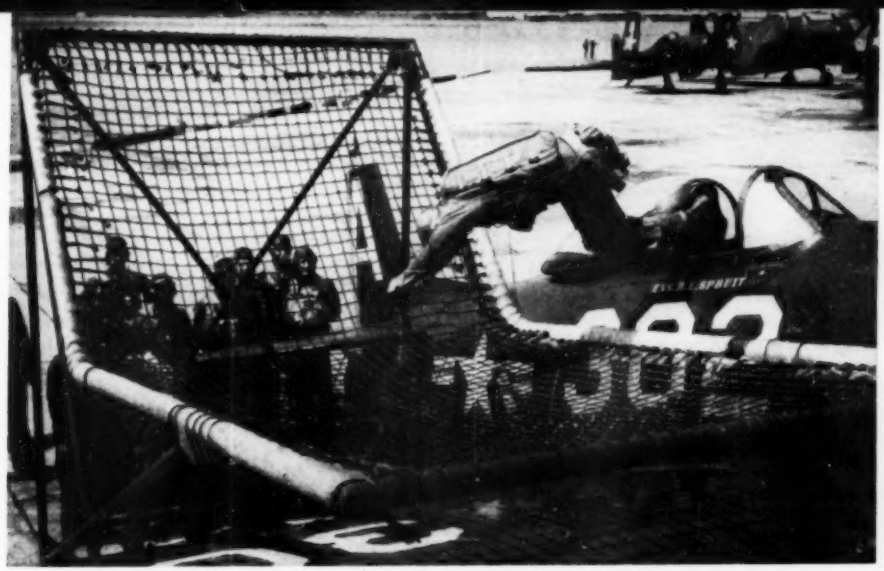
9. Flat plates, welded to tops of piles, serve as bearing surfaces to support weight. Piles now are ready to serve as underpinning for reinforced-concrete foundation of a building.

shorter stroke, and more blows per minute. However, builders sometimes prefer and specify the heavier single-acting type because the force of its blows is absolutely uniform, depending on gravity alone and being unaffected by varying pressure of steam supplied from the boiler of the rig.

Types of piling include timber piles; concrete piles, either precast and driven with the aid of protecting metal caps, or cast in place within driven steel tubing by several patented methods; and, more recently, steel H beams. The last are finding increasing favor, especially in hard-to-penetrate ground such as is found at the UN site. END

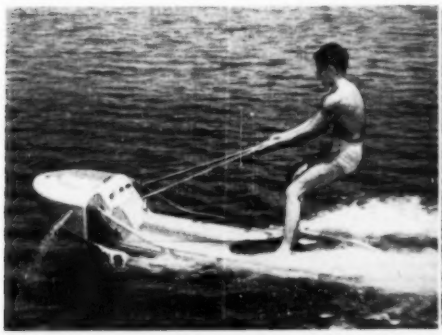


10. Network of reinforcing bars, laid over capped tops of piles, is being wired together above. Final step of pouring in concrete makes piles an integral part of building they support.



Bail-Out Net Trains Pilots

PILOTS learn how to bail out of a speeding plane by making practice jumps on the ground into this new type of net. In use at the Naval Air Station, Alameda, Calif., the net stretches above the plane's wing just below the cockpit rim and turns upward at one end to keep trainees from overshooting it or rolling off onto the ground. Old-type nets were lower and flat, causing occasional injuries. The jumps are made with the plane standing still but with its propeller turning to provide a realistic airstream.



Ridden like aquaplane, motorized Skim Boat® hits speeds up to 35 m.p.h. Unsinkable, it is steered by pulling on hand ropes that run back through side rails to tiller near rear of sled.

Watertight, aluminum compartment (right, above) forms bow and houses 7½-hp. outboard engine. Sled, which hooks on behind, comes apart in sections for easy carrying in car trunk.

Outboard Powers Aquaplane

YOU don't need a boat to pull this aquaplane. A 7½-hp. outboard engine, housed in its metal prow, speeds it over the water at up to 35 m.p.h. Placing the engine up front keeps spilled riders from falling backward into the propeller. And if a rider falls off, letting go of the steering ropes automatically stops the motor. Hansen, Inc., Bryn Mawr, Pa., makes the Skim Boat®.

Weighing only 120 pounds, including engine, sled is 90 in. long, 24 in. wide. Engine's propeller (right) protrudes into water below metal nose. Fin near sled's stern (left) is steering tiller.

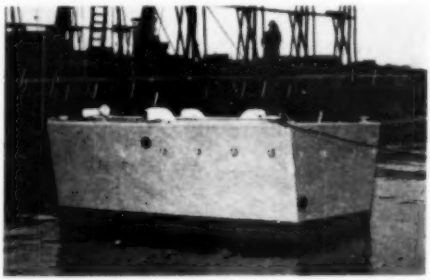
Here's how the Army's come-apart cargo launch looks with its three sections disassembled.

Come-Apart Boat For Arctic Army

ON THE varied terrain of the Arctic, boats are as essential Army equipment as tanks—but they must have overland mobility. That's why this 32-foot cargo launch is built in three sections. Only eight bolts connect the three parts, making possible assembly or disassembly in a few minutes. The bow and center sections weigh less than 800 lb. each, while the stern unit, including the 60-hp. engine, weighs about 1,600 lb.

The all-aluminum boat, built by Edo Corp., of N. Y. C., for the Army, is especially designed for the Far North. Except for the V-shaped section, the bottom is flat, with two runners to facilitate skidding across the ground. Drawing only 24 inches with a load of 5,000 pounds, the boat is ideal for operations in shallow waters. The propeller, located in a semi-tunnel, is protected from damage against rocks. The upswept bow permits the craft to be beached under its own power.

Assembled and launched, the boat has a speed of 10 miles an hour. The enclosed helmsman's cockpit in the rear can be heated for Arctic operations. Canvas canopy covers cargo space.



The rear section, shown above, contains all the controls and the gas engine in a weatherproof compartment. It can be used separately as a marine tractor for moving rafts or barges.

Fully assembled, the sectional launch can be transported in a Fairchild C-82 Flying Boxcar.

Sprayed Plastic Heats Planes

PATCHES of plastic, some thinner and smaller than a postage stamp, are being used to keep ice from forming on vital parts of airplanes and to keep guns warm. The secret: a special type of electrically conductive plastic that acts as a heating element.

Applied to anything that would suffer from low temperatures, the substance, called Electrofilm®, becomes a covering so tough that sandblasting is required to remove it. When electricity flows through it, it heats up, warming aircraft antenna masts, accessories of jet engines, cabin air intakes, bomb-shackle hooks, and the cold-affected parts of guns. Weighing less than an ounce a square foot, it can produce temperatures up to 600° F. It was developed by the E. R. Hall Co., of North Hollywood, Calif.

Electrofilm cemented to bucket bottom and electrically energized boils water in a few minutes. Formulas vary. One type can be applied in watt densities up to 250 to the square foot.

The thermosetting plastic may be brushed or sprayed on. Here wing for wind-tunnel model plane is being treated. Usually applied over varnish, film thickness varies from .003 to .02 in.

GAS STOVE

LAVATORY

SINK

CLOTHES CLOSET

STORAGE CABINETS

ICE BOX

SEATS MAKE DOUBLE BED

SLIDING DOOR

90-HP. ENGINE

Parked by the wayside, the $3,500 house car is at least as comfortable as a roadside cabin.

Backing up or parking is only a little harder than in a conventional passenger car. There's a full-length sliding door on each side. Twin rear-view mirrors show driver his side clearance.

Big windshield and high, independent seats give fine forward visibility. Map table in front is big enough for a child to sleep on. Over windshield is a large storage locker.

Road Cruiser Made from Light Truck

PS Photos by W. W. Morris

COMMON delivery trucks, like the ones your laundryman or baker use, are being converted into "roadable homes" that may soon appear in numbers on U. S. highways. They combine in a single vehicle the housing conveniences of a large trailer, the roadability of a passenger car, and the ruggedness of a truck.

A house car isn't a new idea. Occasional ones have been custom-built for wealthy owners, usually on a bus chassis. Bulkiness, high first cost and fuel bills, and licensing complications have kept their numbers down. Now the Boyertown Auto Body Works, Boyertown, Pa., has begun to make "touring coaches" as a modification of its light delivery truck.

Boyertown house cars use a Ford F-3 chassis having a 122-in. wheelbase. Overall dimensions—18½ ft. from bumper to bumper and 7 feet wide—are about those of a large sedan. In most states passenger-car license plates will serve. Gasoline consumption depends on load, road, and speed, but averages around 10-14 miles per gallon.

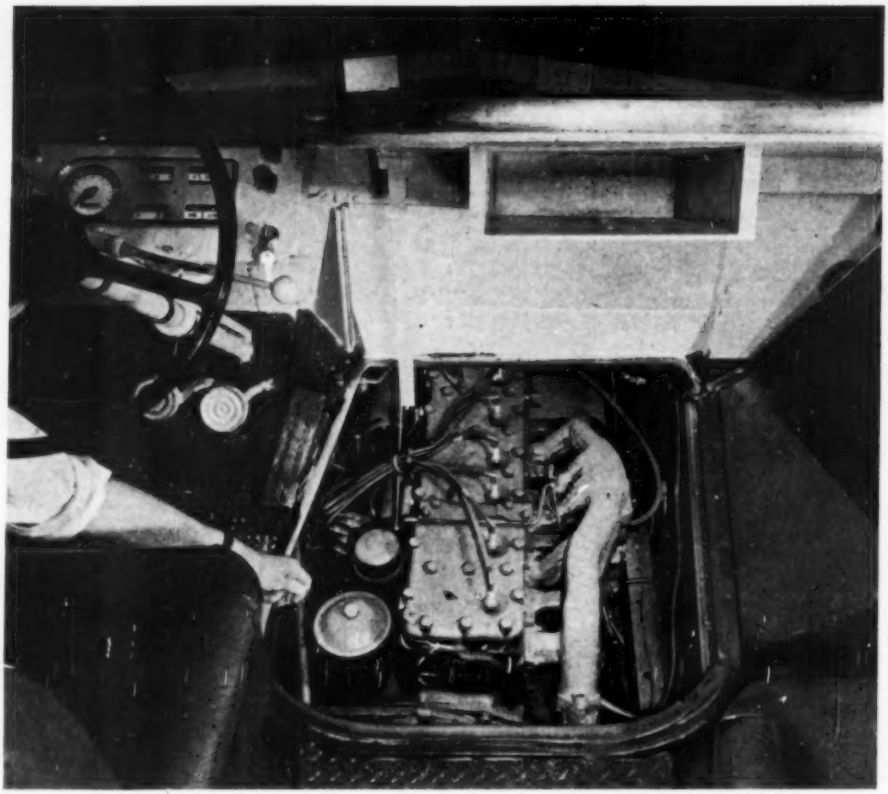
The cab is entered through sliding doors. A third door is in the center of the back. Two trailer-type windows and two fixed-glass portholes in each side light the interior of the body. Further ventilation is provided by air intakes up front, a rear window, an exhaust fan over the stove, and a hinged roof ventilator. A built-in gasoline space heater warms the interior. Two 4-ft. side seats fold down to make a double bed, and there is sleeping space for two other persons in a pinch. The steel body is undercoated and dustproofed, and the roof insulated with Fiberglas®.

Counters topped with stainless steel house a gas stove, a 50-lb. icebox, and a sink fed by a 12-gal. water tank. At the back there's a clothes closet on one side, a lavatory on the other. When both doors are opened across the aisle, they enclose an area that serves as a dressing room. Numerous lockers and cabinets can hold small articles. Excluding the large cab and rear "bustle," the body has 360 cubic feet of usable space. A luggage carrier can be mounted on the roof, and a hitch is provided to tow a box trailer or boat.

This latter-day Conestoga wagon will probably cost around $3,000, with optional extras. For users who don't want to lay out that much money, it may be possible to rent them from drive-it-yourself companies for vacations on the high-road.

Rear window hinges upward and locks there. Curved compartments beside door hold butane bottle for stove and emergency water and fuel cans. Spare tire is in lower compartment.

"Bustle" hinges downward to make ramp and step for rear door. Chain stops it from touching the ground. Locked horizontally, the bustle becomes a small "back porch."



Lifting hinged, insulated cover gives access to 95-horse, 6-cylinder Ford engine. Hand shows location of oil dipstick. The map table swings up to let the engine cover pass.

Oversize radiator is reached by sliding front panel out and down over grille. Twin vacuum motors swing big wipers. The insigne in the center reads "Ford-Boyertown Touring Coach."

Two screw-jacks are pivot-mounted just forward of rear wheels. Let down when the vehicle is parked for the night, they keep body from jouncing on its springs. Tires are 7.50 x 17.

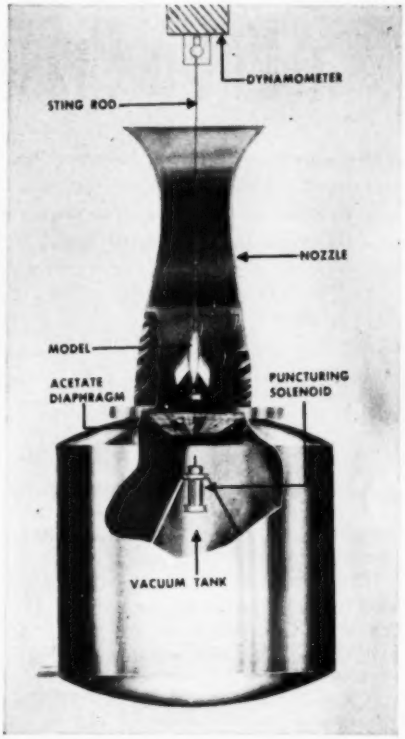
Good meals can be cooked on the three-burner gas range with temperature-controlled oven. Exhaust fan is in locker overhead. Icebox, sink, and more storage space are in counter at right.

Folding center table and long side seats can accommodate four at meals. There's enough headroom inside for a six-footer to stand straight. Table folds flat and can be stowed at one side.

Seat backs bridge aisle to make a comfortable double bed. Rear aisle is big enough to sleep a third adult on an air mattress. A bunk for a child can be fitted at front of the vehicle.

Baby Tank Tests Sonic Models

MOST supersonic wind tunnels are enormous, expensive pieces of apparatus. But engineers of the National Advisory Committee on Aeronautics have designed a baby model that is comparatively easy on the pocketbook. Its supersonic wind is brief, and drag measurements are rough, but that is enough to indicate promising avenues of design.



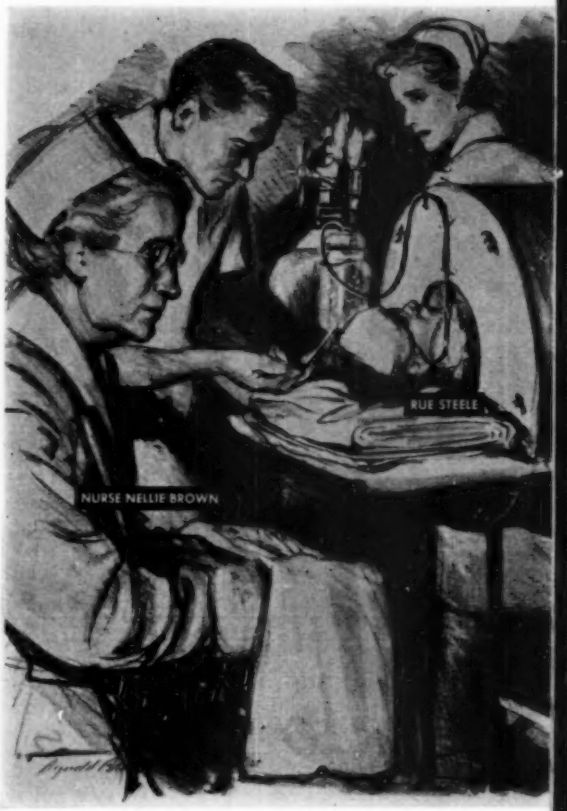
The tunnel consists mainly of a steel tank five feet in diameter and five feet high. Atop it are a supersonic nozzle and a test section. The test section is separated from the tank by a sheet of acetate plastic. Once a pump has created a vacuum in the tank, this sheet is pierced by an electrically operated punch. The air that then rushes into the vacuum tank creates supersonic flow in the test section.

How Native Ingenuity Met a Polio Crisis

From grease drums, vacuum cleaners, and whittled wooden valves, the mechanics of Muncie, Indiana, improvised their own "iron lungs."

By Stewart Rouse
Photos by Ralph Satterlee

Drawing by Reynold Brown from eye-witness description of scene in Ball Memorial Hospital



Firemen, working shifts, kept the tired boy

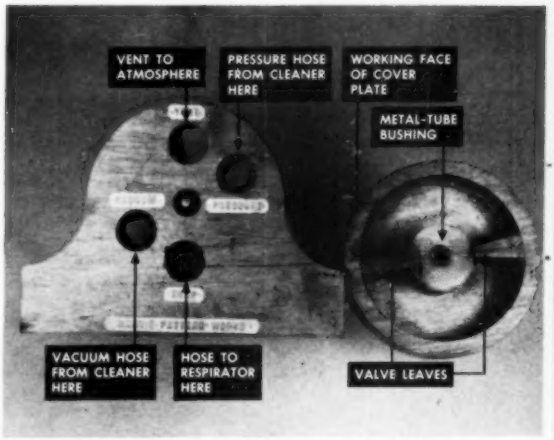
ONE blistering day this past summer the telephone rang loudly in the office of Jack Reichart, an appliance manufacturer in Muncie, Indiana.

"This is Nellie Brown at the hospital," said the voice in the receiver. "You'd better get started on that iron lung we discussed last week. It's an emergency."

A boy was dying.

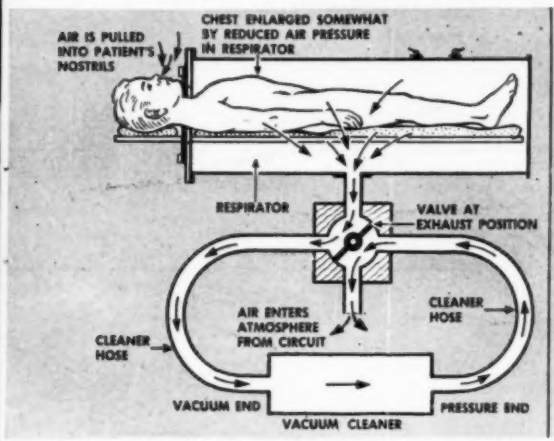
On the Monday morning that Miss Nellie G. Brown, superintendent of Ball Memorial Hospital, telephoned Reichart, polio (poliomyelitis, or infantile paralysis) was becoming epidemic in the city and in the three-county area around it. Some of the cases were the dread bulbar variety, in which paralysis of the diaphragm muscle finally prevents breathing unless artificial respiration is applied. That meant a need for "iron lungs," the specially constructed cylinders into which air is alternately pumped, then partly exhausted at the normal rate of breathing.

But iron lungs are expensive. Anyway,

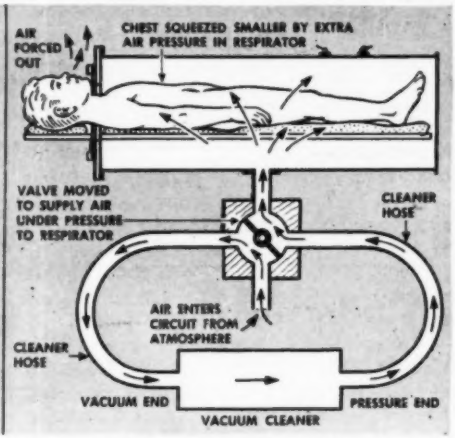


First valves were of hand-carved mahogany. They made it possible to use both ends of vacuum cleaner, thus providing positive pressure in chamber to help patient exhale air in his lungs.

breathing—pressing the air out of his chest with their hands—until a valve could be made.



Tank-type vacuum cleaners ran emergency iron lungs that met Muncie's polio crisis. During inhalation period, valve sends air from iron lung to suction end of cleaner, lets its blower vent outside.



During exhalation part of breathing cycle, valve position is reversed. Air from blower end of cleaner is directed into iron lung. Suction end of cleaner draws air from the atmosphere.

you couldn't buy one that quickly, even with the money. Ball Memorial had three, plus a little portable model. They were already in use. The hospital couldn't wait.

Reichart had a shop accustomed to turning out unusual jobs.

"Can you make an iron lung?" Miss Brown had asked him two days before.

"I don't know," he replied. "I can try."

Over the weekend he had drawn plans for one of the complicated machines, using as a guide an article in a medical magazine several years old Miss Brown had given him.

Now Reichart went to work in his shop. He ripped an end out of each of two big alcohol drums and welded them together. Then he got an ordinary tank-type vacuum cleaner from Sears, Roebuck. He installed a flapper valve in a bung hole on the top of his crude cylinder, and to it attached the hose from the cleaner.

10-Hour "Iron Lung"

He knew he had to control the pulsing of air in and out of the cylinder, so he scrounged around until he found a geared-head electric motor that turned at 3 r.p.m. On its shaft he put a 10-tooth bicycle sprocket. As the sprocket revolved, a tooth moved a little lever actuating the flapper valve. This permitted the vacuum-creating end of the cleaner to draw air from the cylinder 30 times a minute.

When he was done, he glanced at the clock. The job had taken him just ten hours.

The crude but workable artificial respirator was hurried to the hospital. The boy patient was put in this machine-shop version of an iron lung. When the vacuum cleaner pulled down the atmospheric pressure in the cylinder enclosing his chest, he inhaled by muscular relaxation. The reduced pressure also arched the diaphragm away from the lungs and gave them room to expand. When normal atmospheric pressure flowed back into the respirator, 30 times each minute, the boy exhaled.

Local resourcefulness had won the first round. But the crisis with the patient was not over. It had only been postponed.

A few hours later another emergency developed. The boy's chest muscles began to tire. Atmospheric pressure alone was not enough to produce the sharp exhalation needed to keep pumping a supply of oxygen to his system. Doctors gathered around. At the rate the patient was tiring, he had no more than four hours to live. Something had to be done to supply positive pressure outside his chest cavity to force the air out after each inhalation.

The vacuum cleaner was taking part of the air out of the cylinder, but it wasn't forcing any back. Its blower was just venting positive air pressure into the room.

There was the problem: to make some sort of a compound valve with ports that could use, in correct sequence, both the negative and positive pressures already available. Moreover, it had to permit a choice in operating speeds. Human beings of different ages breathe at different rates.

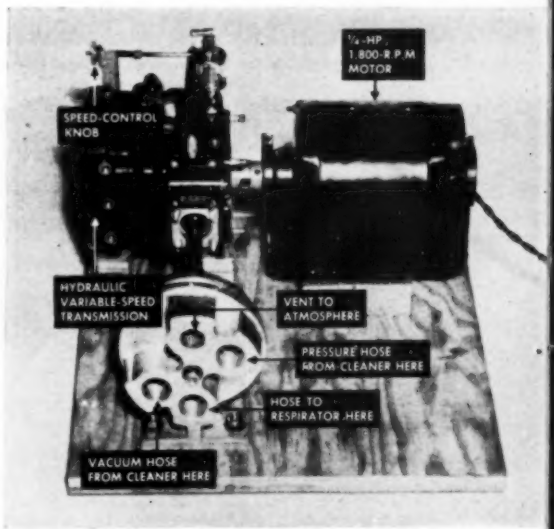
Here the Borg-Warner Corp. stepped in. This firm's Warner Gear Division has no mean talents. Readers of POPULAR SCIENCE know it as the home of the automobile overdrive (PS, Apr. '49, p. 180).

A Warner engineer started to work on that valve. Meantime, volunteer firemen, with their arms stuck through access holes in the respirator, applied hand pressure to the child's chest to aid each exhalation.

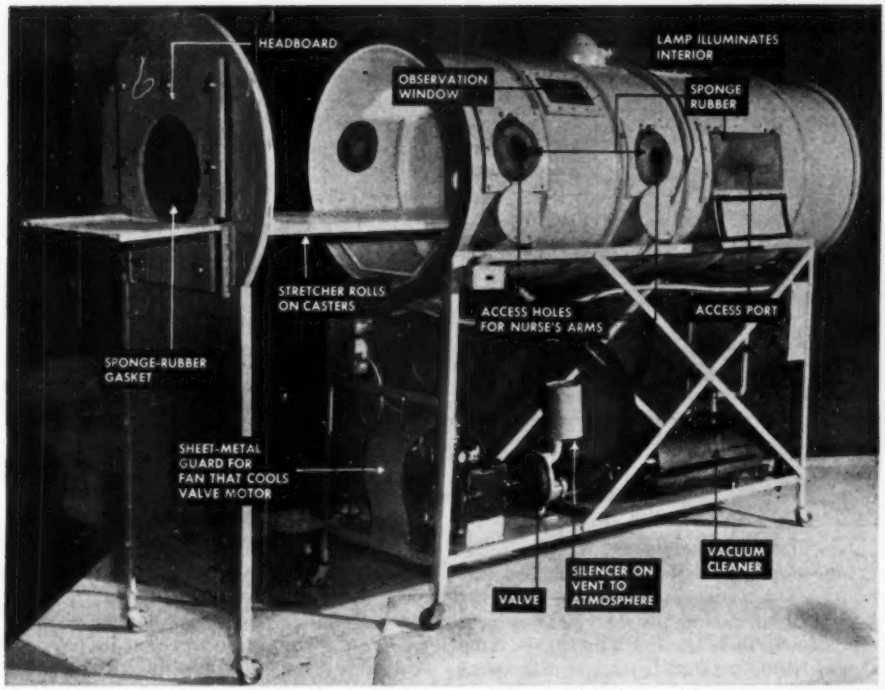
The engineer telephoned two skilled pattern makers.

"Get ready to do some fast whittling," he said. "We're trying to save a life."

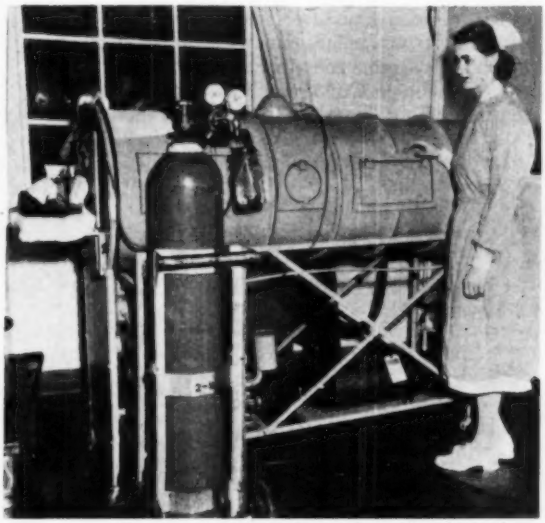
In just 90 minutes the engineer had drawn up a design for the valve. The pattern makers whittled. The wood over which their



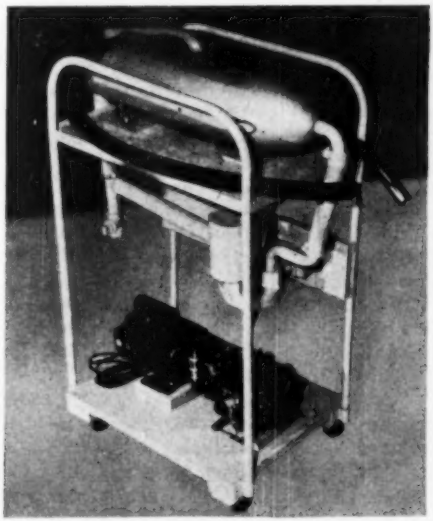
This is a close-up of the motor-driven control-valve unit. In time, aluminum casting replaced handmade wooden valve. Valve allows an inhalation time twice as long as the exhalation period.



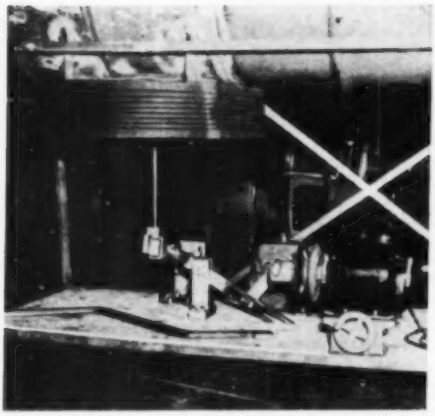
This is a general view of "production-line" iron lung, local ingenuity's answer to the Muncie emergency. Headboard is pulled away from chamber. The model shown above incorporates the latest improvements, including a fan to cool the electric motor that turns breathing-cycle valve.



On duty in hospital, machine shops' iron lung is supplemented with oxygen apparatus for patient in critical condition. Cleaner and valve assembly are mounted on plywood sheets.



In case of breakdown of cleaner unit, portable emergency unit is provided. It can be plugged in instantly to restart respirator. Connections are regular hose, ferrule fittings.



Warner Gear produced another type of iron lung in which single bellows both pressurizes and evacuates cylinder. Bellows is 24 in. in diameter, 10 in. long extended, 6 in. collapsed.

hands flew was mahogany. It was tough going—mahogany is hard. But in just four hours a two-piece wooden rotary valve had been fashioned and installed in Reichart's emergency iron lung. For the next ten hours it was hand-operated by one of the volunteer firemen.

The child patient, his weary chest muscles relieved of the task of expelling the air from his lungs, was breathing at a normal rate.

But in the Warner workshop one thing remained to be done. A motor drive had to be devised for that valve. The engineer went back to his bench. Several war-surplus, variable-speed hydraulic transmissions—the kind that revolve power turrets on bombers—were lying around.

To the input shaft of one of these transmissions he connected a ¼-h.p. electric motor turning at 1,800 r.p.m. On the output shaft he put a steel yoke to turn the valve cover plate of the iron lung's wooden valve at any desired speed. By twisting a knob on the transmission, the respiration rate of the lung could be set to any speed from 15 to 38 breaths a minute.

The valve motor drive was installed. The youngster in the lung was given a new, if momentary, lease on life.

Now that they had proved it could be done, both Warner Gear and Reichart proceeded to make mechanical respirators as fast as they could to meet the challenge of the epidemic. Other wooden valves were turned out. Other power turret transmissions were found in the area. Sears continued to supply vacuum cleaners without charge. Many other retail stores, supply houses, and manufacturers joined in donating much-needed materials and services.

Presently the wooden valves were replaced by metal ones using a steel rotating cover plate and a stationary aluminum port plate. Castings for these, requiring a minimum of machining, were produced at a Muncie foundry. For "production-line" respirators, two 55-gallon steel grease drums were substituted for the alcohol drums. The grease drums required less work. They had removable lids.

Failure of a vacuum cleaner had to be thought of. What would happen if one of the units got out of order? So Warner began supplying a portable valve unit, valve drive, and vacuum cleaner, ready to plug into a respirator if anything went wrong.

New Respirator Devised

Not content with that, Warner designed and sent a new type of respirator to the hospital to be put to work. This one was bellows-operated. A concertina-like bellows made by a Muncie organ company provided both the vacuum and pressure phases of the operating cycle. A single pipe connected it to the respirator. When the bellows was extended, it caused a partial vacuum within the lung. When it was collapsed, it built up pressure in the lung. No valves were required except the relief valves to control the amount of vacuum and pressure.

It would be good to close the story of the emergency iron lungs with the news that the young patient who inspired the work, Rue Steele, son of a Muncie truck driver, recovered from his polio attack. We can't. The paralysis induced by the disease eventually proved too much for his 10-year-old body to combat.

But he left a legacy—a growing row of iron lungs created by native inventiveness, produced by a couple of Midwestern machine shops, in the American tradition of ingenuity and self-help. And because of this, several other children and adults are alive today in Muncie, Indiana. END

Tractor Carries Rescue Gear

A LIGHT tractor developed in England has a power winch and 100 yards of cable mounted in front to pull itself across a field if the going gets too tough when plowing a deep furrow.

Meteor jet fighter approaches funnel-tipped refueling line to replenish tanks in experiment.

Contact is made. Note perforated dive brakes used to slow plane's speed, maintain altitude.

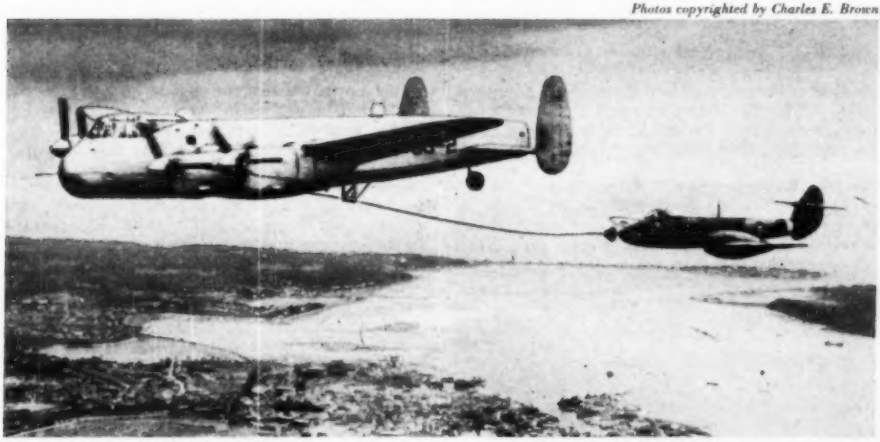
Jet Refuels Like Humming Bird

STICKING its nose into a refueling funnel in mid-air as a humming bird would explore a flower, this British jet fighter was able to stay aloft for twelve hours. With a normal flight duration of only 90 minutes, it had to take on fuel ten times.

In this new type of refueling, in which the Meteor, Britain's fastest jet, was used, the objective was to determine whether the range of such aircraft could be increased. Incidental to the experiment was the setting of what is believed to be a new world's record for jet-flight duration. A propellered plane was used as a tanker. A total of 3,000 gallons of kerosene was transferred.

Once contact was made, the tanker proceeded to pump fuel rearward to the jet. Britain, a pioneer in mid-air refueling, started experiments before the war.

Photos copyrighted by Charles E. Brown

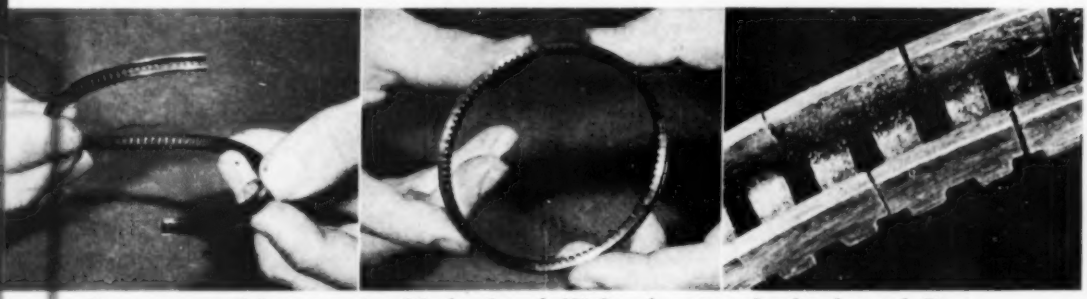


Here is a side view of refueling operation as jet noses into cone slightly below tanker's level.

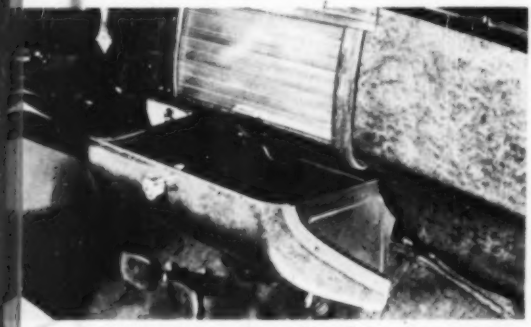
1950 Nash Boasts Longer-

AN ENGINE reported to run 50 percent longer between major overhauls is the big feature of the 1950 Nash, unveiled late last month. The secret lies in just one change—a new type of piston ring that always keeps the right amount of oil flowing to the cylinder walls. It does this even when the cylinder is worn or out-of-round, say Nash engineers.

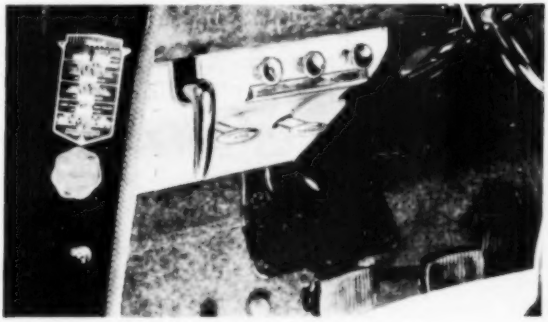
While keeping the same general styling, Nash has increased window area and slicked up the interior. Some models have a back-



Key to expected longer engine life for the new Nash is Seal-Flex® oil control ring, developed by Thompson Products. Lowest of four rings on piston, its oil-wiping surface is formed by U-shaped sections placed end to end. Tiny slots, .001" wide, channel oil to upper cylinder walls. Tests show wear has little effect on the size of slots, maintaining good oil economy.



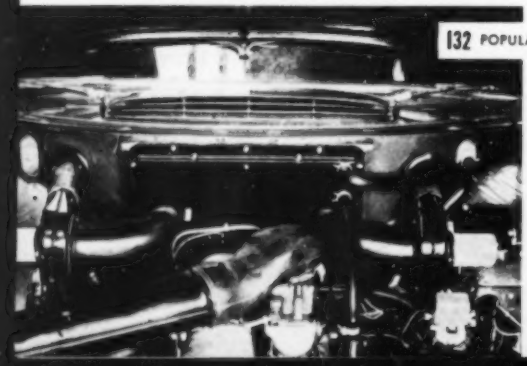
Sliding bin replaces drop-door glove compartment. Maps, knickknacks can't fall out. Roll-top sliding panel covers radio, secondary driving controls. One lock secures bin and panel.

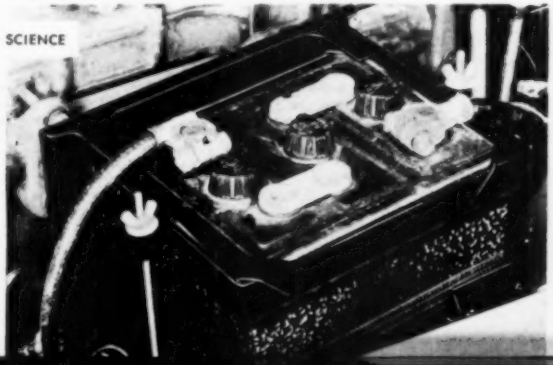


Basic controls are grouped at left of steering column where they're easy to reach. Hydra-Matic is now optional in Ambassadors; when used, engine is started by lifting selector lever.

Nash's Weather Eye air conditioner is improved. Defroster effectiveness is increased by dual blowers and motors, one for each side of windshield. One knob replaces two on heater.

Metal shield now protects battery from engine heat on hot days. Ambassador has vertical tube radiator, replacing cross-flow type. Hand-brake cable is fully enclosed in housing.

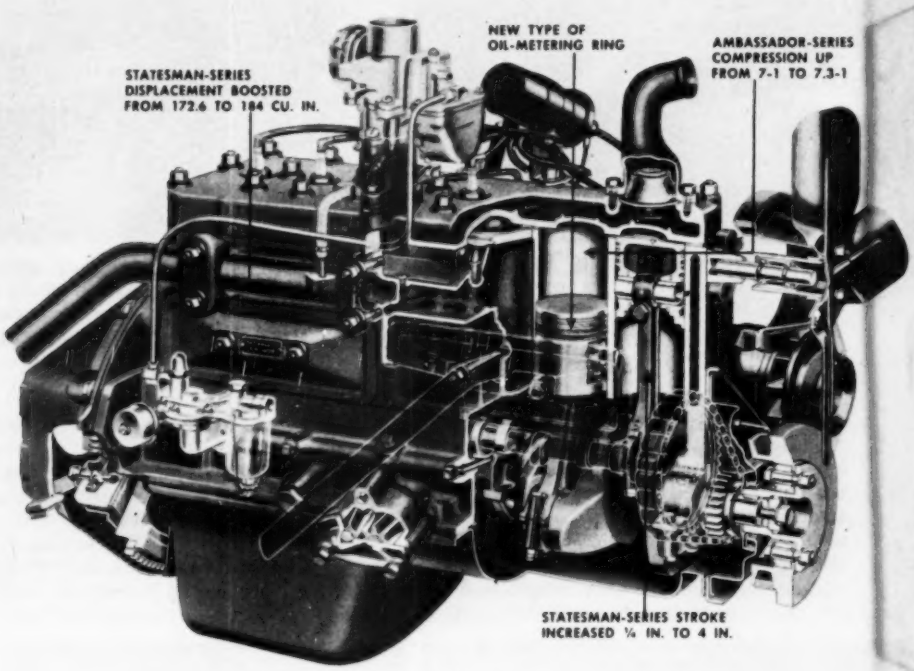




Lasting Engine

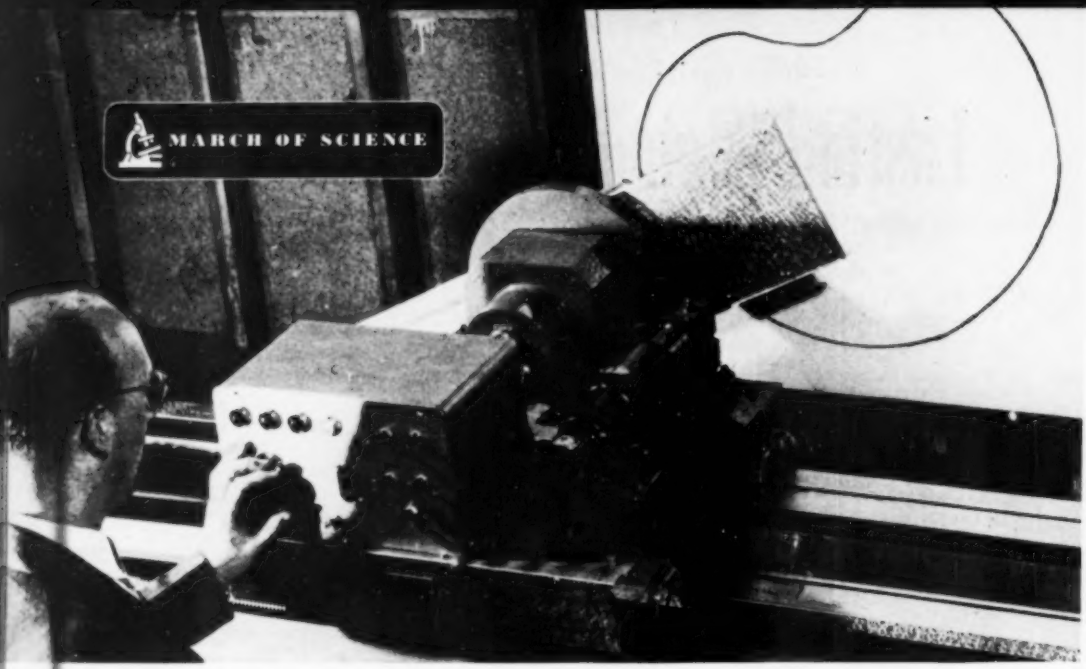
seat armrest big enough to play gin rummy on and a front seat adjustable to any angle.

In the Ambassadors the compression ratio has been boosted. In the Statesman—which replaces the "600" series—the stroke is longer and the displacement bigger. END



New engines feature improved cylinder heads, harder valve stems, and better lubrication.

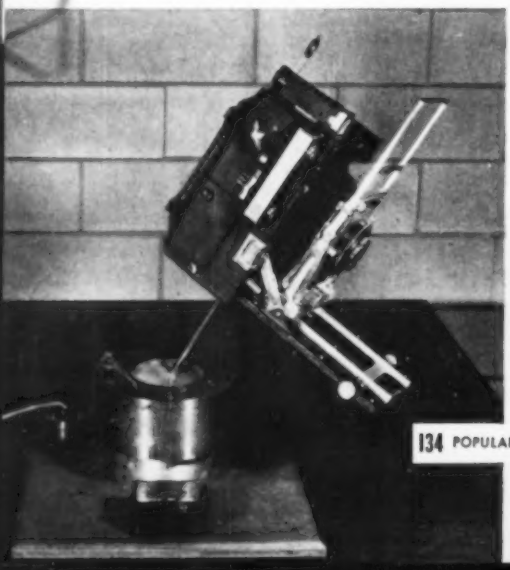
Right front seat has feature motorists have been wanting for years. It is airplane-type, can be adjusted to three intermediate positions plus upright and horizontal. Fully reclined, seat forms one of twin beds that have long been Nash accessory. Available as extra-cost, optional equipment on all models, it can be made up and used as a separate bed while car is moving.



Eye Guides Cutting Tool. Odd-shaped pieces of metal can be cut out automatically with the help of GE's electronic "contour follower" above. A microscope and photoelectric cell nose along an outline drawing. If they deviate as much as 3/1,000 inch from the path, an electronic signal brings them back. Controls order a jig-boring machine to move in exact synchronism, cutting the shape in metal.

Magnetism Holds Camera. Turn off a switch and you can tilt the camera below to any angle. Turn it on and the camera mount freezes. The tricky "pan head," a Bureau of Standards' adaptation of its magnetic clutch (PS, June '48, p. 83), consists of a metal ball in a socket containing oil and iron filings. When magnetized by an electromagnet, the mixture solidifies.

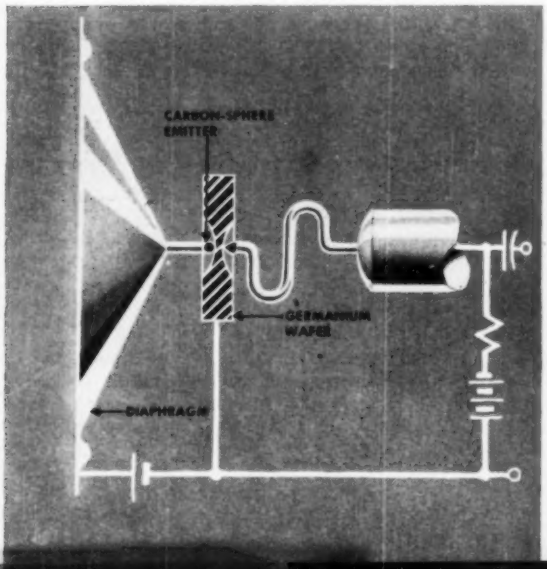
Machines Fret, Too. In big thrust bearings, the mating parts shift less than a millionth of an inch, but that is enough to cause mechanical and chemical action that eats away the metal. Westinghouse engineers use the model below to find ways of stopping this "fret corrosion." "Pipes" sticking up are spring-loaded screws that can vary pressure between parts.



Study Trapped Light. It looks like Dr. Daniel Alpert has bottled up some light in the sealed, unconnected flask at right above. Actually, the flask contains sodium vapor, which radiates light of its own when struck by ultraviolet light from the projector at left. By studying such phenomena, Westinghouse Research Laboratories hopes to improve fluorescent tubes and perhaps discover new light sources.

New Mike at Last? Edison invented the carbon telephone transmitter 72 years ago and it is still used today, basically unchanged. But now Bell Laboratories scientists have produced a new kind, employing the Transistor® (PS, Sept. '48, p. 117), that may someday replace it. When the diaphragm vibrates, it moves the Transistor's "emitter" (see sketch), varying the current.

Baking Preserves Crystals. The quartz crystals that keep radio, television, and radar equipment in tune are now being baked in ovens to make them stay young. Ordinarily the crystals change their characteristics with age, causing their frequency to "drift." The new heat treatment, developed by physicists of the Army Signal Corps, makes them last indefinitely.



Planes "Type" Messages in Sky

Radio taps the keys as seven-ship flying typewriter prints 15-mile-long placards at 10,000 feet.

By Herbert Johansen

WRITERS in the sky have abandoned old-fashioned, one-plane "penmanship." Now they're "typing" out their aerial messages in neat block letters.

The "keys" of Skytyping are seven planes that fly a straight, parallel course across the sky. Electronic controls puff smoke at preselected intervals to form celestial letters as in the word "T E S T," shown in the photo at the top of this page.

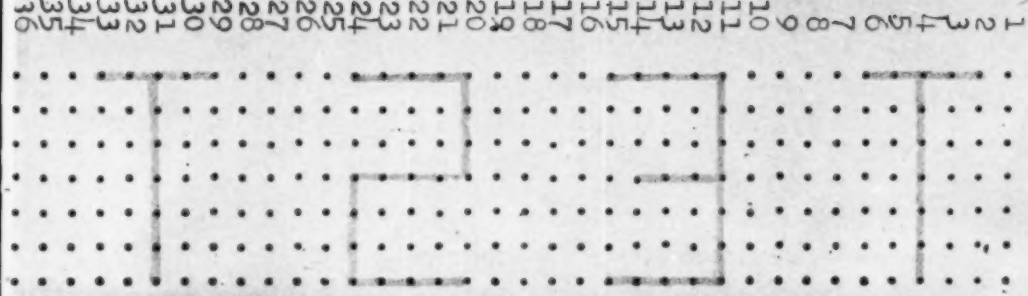
A "mother" plane, flying in the center of the formation, automatically controls the entire operation. It transmits a constant stream of radio tone signals at one-second intervals. As receiving sets in each of the seven planes, including the mother plane, pick up the signals, switches are thrown in a control board that has 200 plug-in sockets. The board in each plane has been preset according to a message pattern.

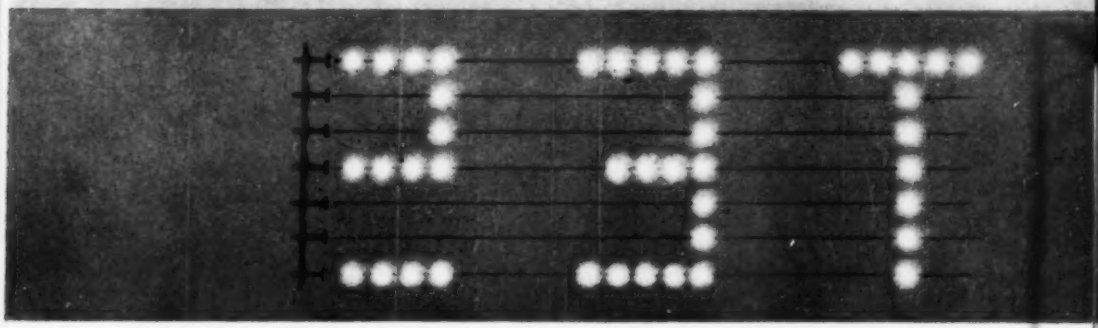
When a puff of smoke is desired to form part of a letter, a plug-in closes an electronic circuit. That, in turn, opens a special valve in the engine, releasing a small quantity of oil-base chemical into the exhaust pipe. Heat of the engine expands the chemical into smoke at a rate of 1,000,000 cubic feet a minute. The result is a huge, 375,000-cubic-foot smoke puff left in the sky. Where no puff is desired, there is no plug-in on the control board, and the switch activated by the mother plane's radio tone clicks a blank.

Skytyping, a patented process, is the brain child of S. S. Pike, head of The Skywriting Corporation, New York. Since it requires fast planes of equal performance, he only dreamed of his sky-printing process for many years until war-surplus AT-6 Air Force trainers became available. Then he went to work with electronic engineers to develop the complex radio equipment that could belch an educated aerial alphabet.

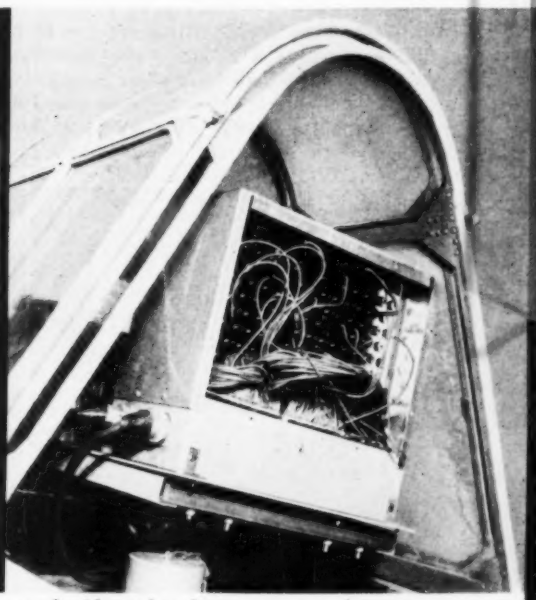
Early Experiments Produced Queer Results

Metropolitan New York saw the first samples of the flying typewriter at work. And early experiments left many citizens with cricks in their necks and puzzles in their minds. Failures of the electronic relays played some queer tricks. A puff skipped here and there, and a message would resemble something written in Arabic or Chinese. And more than once the Skytyping pilots, all war veterans, feared they might have been putt-puffing highly censorable phrases.

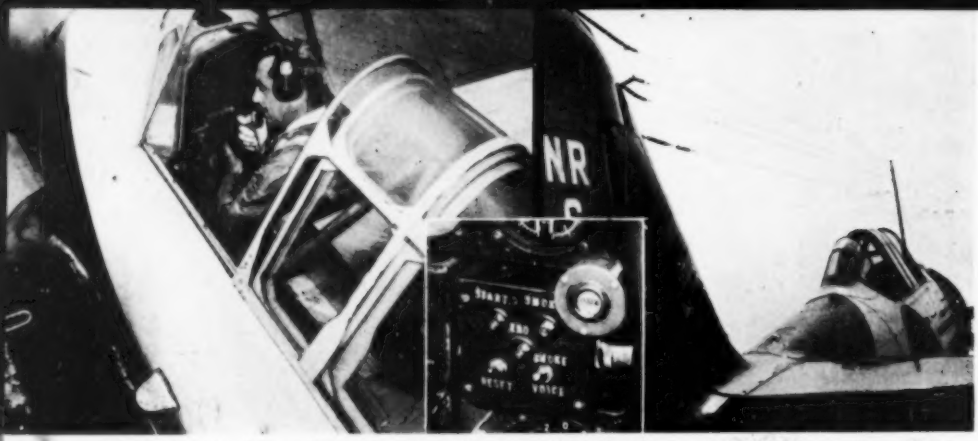




Letters of a message are drawn on a strip of paper, using seven rows of numbered dots. Each row represents the flight path of one plane. Where lines cross dots, corresponding plugs are inserted in the plane's control switchboard. Each will let radio signals close a circuit, causing puffs of smoke to form the sky letters. Written backwards, they appear normal from ground.



Rear seat in the AT-6 cockpit is filled with radio equipment, as seen at left above. It is war-surplus Navy apparatus rebuilt for Sky-typing. At right is rear view of the control panel. Plugged-in lines represent sky spaces where this plane will puff smoke to form its part of each letter. A 70-gallon chemical tank is located just below the control panel.



Chief pilot in the mother plane gives the go-ahead over voice transmitter when the planes are lined up. Inset shows his switch panel that controls the operation. Switch at lower left, flipped when a light indicates the end of a message, resets the electronic relays for another run. Photo at right shows the special transmitting antennas of the control plane.

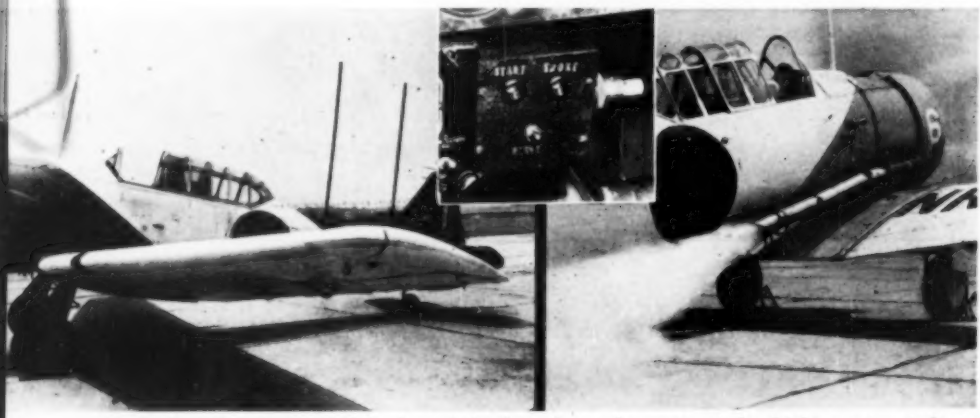
But that's all straightened out now, according to Mr. Pike. His spelling planes do a smooth job. Flying at about 180 m.p.h., a team of seven AT-6s can print a 21-letter, 15-mile-long message across the sky in five minutes. Each letter, approximately a mile long and half a mile wide, is made in 10 seconds flat.

The messages, or slogans, are written at altitudes of from 10,000 to 15,000 feet, depending on air turbulence. Pike says that on clear days his Skytyping can be read 40 miles away, with the letters remaining intact as long as half an hour.

In the old, one-plane skywriting, the first letter of a word is often gone with the wind before the last letter is formed. It also involves complicated flying maneuvers, with hazardous loops, rolls, and dives needed to form the characters.

In Skytyping, on the other hand, the pilots simply fly a straight line. Everything else is automatic from the word "Start," called out by the pilot of the middle mother plane over his voice radio.

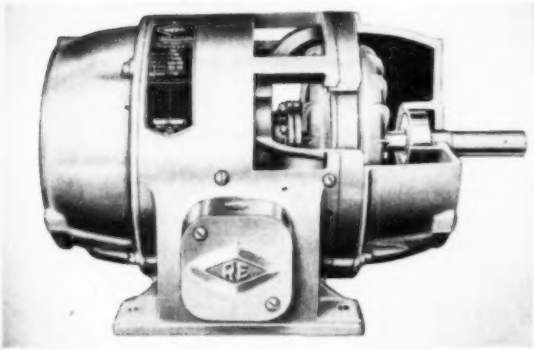
When the full message has been spelled out, as preset in the switchboards, a light signals "End," and the control pilot orders everyone to flip a "Reset" switch that zeroes the electronic relays, readying the planes' smoke-puffing apparatus for another spelling run across the sky. END



Guide bars on wingtip at left above help the pilots to line up with the mother plane in flight and to maintain an interval of 400 feet between planes. Simplified switch box shown in inset has only reset switch. Lights on top indicate that message has started and that smoke puffer is working. Photo above right shows a smoke puff leaving engine exhaust of plane on ground.

Station Wagon Has Jeep Drive

THE war-famous jeep now comes in a station-wagon model that has the same selective 2- and 4-wheel drive the jeep used during the war. Loaded to its half-ton capacity, the car can climb a 59-percent grade. Willys-Overland, the manufacturer, says it can travel off the road through mud, snow, or sand that would bog down ordinary vehicles. It has a 104½-in. wheelbase, comes with either right- or left-hand drive.

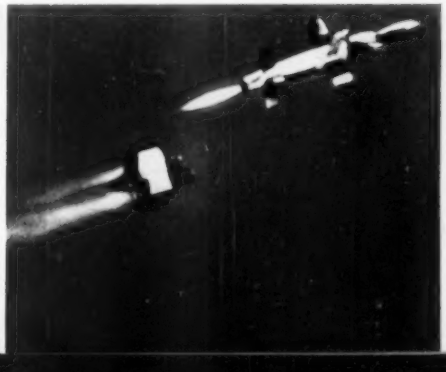


Motor Gets Fluid Drive Shaft

THE new electric motor at left is the first of its type to feature a fluid coupling built right into its drive shaft. Designed to permit easier starting under heavy loads and to prevent jamming, the combination motor and oil drive is said to occupy about the same space as a motor alone and to cost less than two separate units. Among its applications are conveyers, extractors, and bridge and trolley drives for cranes and mixers. Made by the Reuland Electric Co., of Alhambra, Calif., the Fluid-Shaft® motors range from ½ to 10 hp.

Dropped Rocket Boosts New Navy Missile

ONE of the newest wrinkles in guided-missile research is the Navy's Lark, launched from aboard ship. Officially designated the NSAM-N-4, it is powered primarily by a high-thrust, liquid-fuel rocket motor, but as it is launched (below, left), added boost is supplied by a jettisonable twin rocket. This is shown dropping away from the missile at right. Made for the Navy's Bureau of Aeronautics at the San Diego plant of the Consolidated Vultee Aircraft Corp., the new missile is designed to intercept enemy planes.



Rare Metals, Once Forgotten, Now in Production

Metals of atomic age may have names like praseodymium, thanks to new process for purifying rare earths.

By Alden P. Armagnac

SPANG in the middle of Iowa there's something nearly as tall as the corn—and more exciting. It's a bank of glass tubes. Out of them come strange metals, some of the most precious on earth, whose unusual properties may prove vital to the atomic age.

They once were rarer than diamonds and actually priceless. Even now, being produced in pound lots by a method born of the atom-bomb project, they cost up to 31 times their weight in gold.

Few people have ever seen them. Gray to light gray with high metallic luster at

Worth 31 times its weight in gold, silvery praseodymium metal in vial at left is sealed from air, which turns it black. One source of rare-earth metals is monazite sand, above.

first, they turn odd shades on exposure to air—pale yellow, cream color, black, grayish pink. Their compounds vie in brilliant hues with the colors of the rainbow.

Called the "rare-earth" metals, they are true chemical elements, just as iron, copper, and silver are. Their names sound like something out of an apothecary shop—lanthanum, cerium, praseodymium, neodymium, to mention a few.

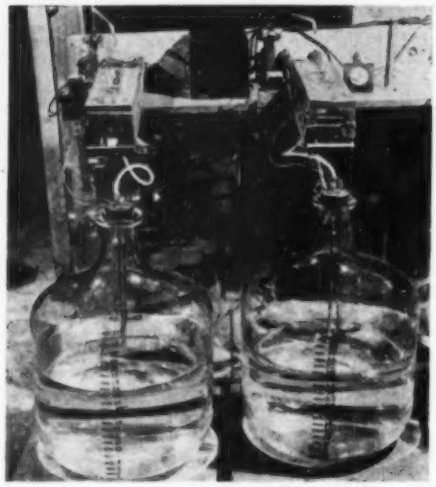
Small wonder if the names are new to you. For the whole group of 15 rare-earth metals, listed on page 143, might well be called the "forgotten elements." They make up nearly one-sixth of the 96 known elements, the basic materials of which all things are made. Yet a typical college textbook on chemistry, more than 1,000 pages long, devotes a scant two pages to them.

Practical uses have been as few in proportion. Just one may be familiar to most laymen. Spin the wheel of your cigarette lighter, and you are striking fire from pyrophoric, or spark-producing, rare earths, cerium metal in particular, in the alloy of the flint. Lanthanum oxide goes into special optical glass for aerial-camera lenses. Neodymium oxide absorbs glare in glass-blowers' goggles. Carbon-arc projectors in movie theaters give an intense white light because of rare earths in the carbons. There have been a few other uses for rare earths, but not many.

Today, however, these forgotten elements have become news. Atomic research has focused the spotlight upon them. And under the direction of Dr. Frank H. Spedding,

Glossy black portion of gadolinite ore, pointed out above, also yields many rare-earth elements. Ore and one of metals, gadolinium, are named after Finnish rare-earth chemist Gadolin.

Dozens of these eight-foot-tall ion-exchange columns, at Ames, Iowa, "refinery," accomplish feat of separating rare-earth elements, which are almost identical chemically.



Ingenious control automatically switches output of column from full to empty collecting bottle. Rising liquid trips electric circuit, shifting carriage holding funnels and delivery tubes.

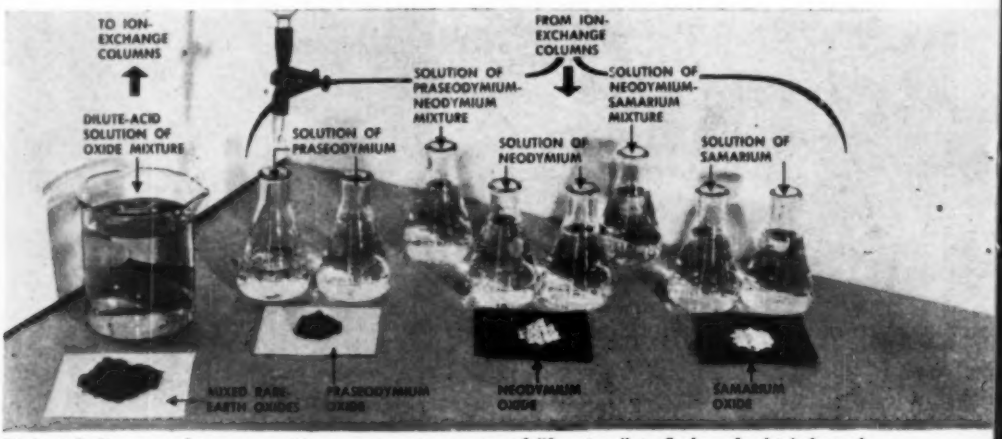
Iowa State College chemist, the Ames Laboratory of the U. S. Atomic Energy Commission has begun producing highly purified rare-earth metals and compounds in unprecedented quantity.

One object is to see if they may be useful materials for future atomic power plants—for instance, in control rods and in lightweight shielding against dangerous radiation from atomic engines of ships and planes. Forming as "ashes" in uranium rods of piles, rare earths have been a nuisance, tending to put out the atomic fires by absorbing neutrons. But that very vice would be a virtue in shielding and control.

"Moreover," says the U. S. Atomic Energy Commission, "it now appears that they may have a bright commercial future as alloy metals in the manufacture of high-temperature structural materials."

It's partly the small proportion of rare earths in the earth's crust—there's as much gold in sea water—that makes them "rare," not scarcity of places where they can be found. One widely distributed ore is the yellow-to-brown monazite sand of the Carolinas, Brazil, Africa, and India. Norwegian mines furnish gadolinite, a glossy black rare-earth ore, and others. Rare earths of commerce have been relatively inexpensive "concentrates" or crude mixtures obtained from these ores. For example, cerium for cigarette-lighter flints is a $4-a-pound commercial alloy known as "mischmetal," consisting of cerium and seven other rare-earth metals, and other impurities.

But one of the biggest reasons the rare earths are so "rare" is their unusual chemical resemblance to each other. They are so much alike that ordinary chemical methods cannot separate one from the others. *Years* of tedious evaporating and redissolving were formerly necessary to get a few specks of material.



Pictorial diagram shows separation process at a glance. Rare-earth oxide mixture, dissolved in acid (in beaker) goes into columns. Rinsing with citric acid and ammonium citrate yields series of "fractions" in flasks, of which last obtained is beneath delivery tube. From pure fractions, oxalic acid precipitates oxalates, converted by heat to pure oxides shown.

Then in early 1944, workers on the atom-bomb project, including those at Ames, Iowa, made the amazing discovery that rare earths formed by uranium fission could be separated—in hours instead of years—simply by passing a solution of them through a vertical tubeful of synthetic resin. Samples were, at first, sub-visible "tracer" quantities; later, visible ones of ten-thousandths of an ounce.

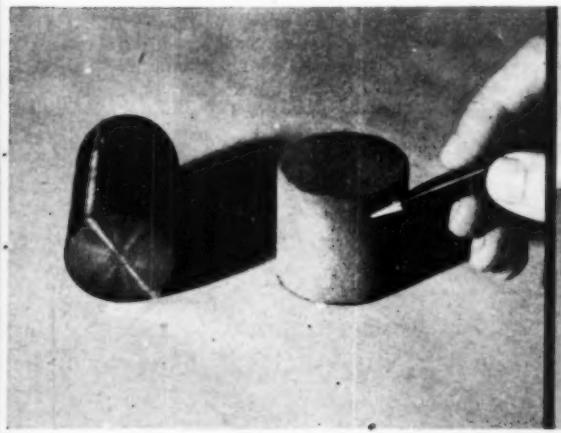
Exciting news came from Clinton Laboratories at Oak Ridge, Tenn., when two young chemists separated a mysterious substance from fission-produced neodymium with one of the new resin tubes or "ion-exchange columns." It proved to be the long-missing rare-earth element No. 61, which they named prometheum. Radioactive and shortlived, it is believed non-existent in nature. First visible samples, pink and yellow smears on white porcelain disks, are minute quantities of prometheum nitrate and chloride respectively.

In the meantime, Dr. Spedding of Iowa State proposed as bold a step-up in scale as that from a pinhead of plutonium to pounds of it for the bomb. Instead of being content with "micro" quantities of pure rare earths, why not adapt the new method to produce them in "macro" amounts of grams or even pounds? He and his colleagues installed a battery of 24 resin columns, eight feet tall and four inches in diameter—and made history by accomplishing the feat.

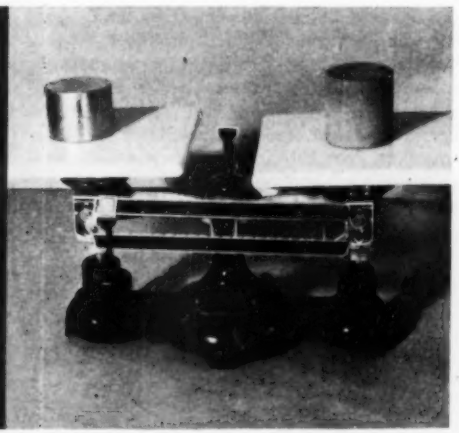
Watching the precious liquids trickle from glistening glass columns into collecting bottles the size of cider jugs, a visitor to this pilot plant hardly realizes the miracle taking place in the tubes.

These Are the 15 "Forgotten Elements" Known as the Rare-Earth Metals

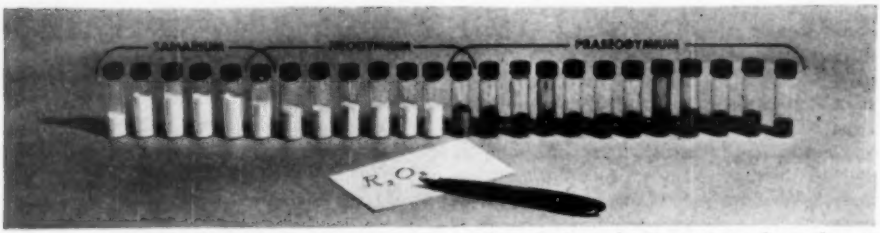
NAME (with source or meaning)	*CHEMICAL SYMBOL*	*ELEMENT NO.:*
LANTHANUM *"To lie hidden"—Greek.*	**La**	**57**
CERIUM *Ceres, a planetoid.*	**Ce**	**58**
PRASEODYMIUM *"Green" (from color of salts), "twin"—Greek.*	**Pr**	**59**
NEODYMIUM *"New," "twin"—Greek.*	**Nd**	**60**
PROMETHEUM *Prometheus, mythical fire-giver.*	**Pm**	**61**
SAMARIUM *Samarski, a Russian mine official.*	**Sm**	**62**
EUROPIUM *Europe.*	**Eu**	**63**
GADOLINIUM *Gadolin, Finnish chemist.*	**Gd**	**64**
TERBIUM *Ytterby, in Sweden, source of rare-earth ore.*	**Tb**	**65**
DYSPROSIUM *"Hard to get at"—Greek.*	**Dy**	**66**
HOLMIUM *Holmia, Latin name for Stockholm.*	**Ho**	**67**
ERBIUM *Ytterby—see above.*	**Er**	**68**
THULIUM *Thule, or "Northland."*	**Tm**	**69**
YTTERBIUM *Ytterby—see above.*	**Yb**	**70**
LUTECIUM *Lutetia, Latin name for ancient Paris.*	**Lu**	**71**



Air gives cerium, right, this cream-colored coating. Freshly machined lanthanum, left, shines like steel. Each sample of rarely seen metal weighs 1.3 lb. and is valued at $1,200.



Rare-earth metals are only moderately heavy. Cerium on right-hand side of scales, with density 6.8 times that of water, is balanced by smaller piece of copper with density of 8.9.



Yields of rare earths in oxide form, from series of 12-hour runs through columns, show almost total separation of test mixture of equal parts of samarium, neodymium, and praseodymium.

Into the top of a tube goes a hodgepodge of rare-earth elements—redissolved in acid after acid extraction from the ore and crude preliminary chemical separation into two main groups, light and heavy.

Like flies to flypaper, ions—individual charged atoms—of rare earths stick to the resin at the upper end of the tube. Thus they are strained—"adsorbed" is the technical word—from the acid, which is then removed by washing.

Down Go the Ions

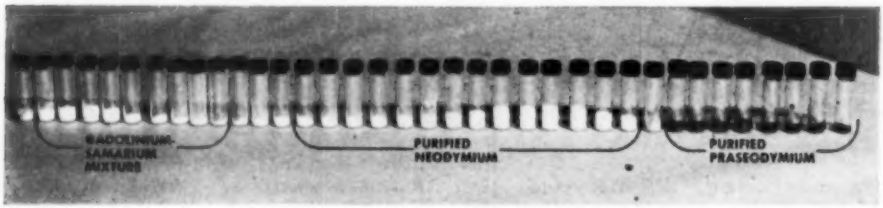
Now a dilute solution of citric acid and ammonium citrate is poured down the column. Rinsed from the resin, or "eluted" if you prefer the scientific term, a typical rare-earth ion starts down the tube. Almost at once it sticks to the resin again. This skip-stop progress repeats itself, over and over, all the way to the tube's bottom.

Eventually all the rare-earth particles reach bottom. But those of the element of highest atomic number get there first; those of the next highest number, next, and so on. Switch the liquid output from one collecting bottle to another, at the right time intervals, and nearly every bottleful or "fraction" will contain a single purified rare-earth element. A few fractions in which elements overlap are re-treated; and purified fractions, if still higher purity is wanted, may also be run through a column again.

The solutions yield oxalates, by precipitation with oxalic acid. Then heat treatment converts these to the rare-earth oxides—the form desired for many experiments and from which other compounds may readily be prepared. Purity runs around 99.9 percent.

By "smelting" rare-earth oxides when enough are on hand, the Ames workers produce miniature ingots of the pure metals—tiny 1/20-oz. cylinders of silvery praseodymium and neodymium metals, sealed against corroding air in helium-filled glass vials, and comparatively massive 1.3-lb. chunks of cerium and lanthanum metals. Their weight compares with iron, their softness with calcium; like the latter, they react with water, liberating hydrogen. Producing one avoirdupois ounce of praseodymium costs almost $1,000; of neodymium, $170; of lanthanum and cerium, $57 each—compared with the **$31.90** value of an ounce of pure gold ($35 per *troy* ounce).

If new uses require pure metals, even these prices—which the experimenters hope to reduce—may not be commercially prohibitive. Like radium in watch dials, a little may go a long way. Or like platinum in chemical crucibles, advantages may outweigh cost. But it is primarily for research that scientists prize the newly available pure preparations. At last their long-mysterious properties can be fully explored for possible exploitation. The "forgotten elements" are forgotten no longer. END



Results of another test show successful recovery of neodymium and praseodymium from complicated mixture of other rare earths including hard-to-separate gadolinium and samarium.

Atom Barrage Cleans Metals

ATOMS have found a new use in industry—they're being shot at pieces of metal, like peas from a blowpipe, to clean off the top surface. Following this treatment, called cathodic vacuum etching, microscopic examination reveals lines showing how the metal "flowed" when forged under high pressure.

The new process, developed by the Ford Motor Co., works like this: A metal sample is placed in a vacuum, above, with some argon (the gas used to fill light bulbs). A potential of 12,000 volts shoots charged argon atoms down at the metal sample, and the speeding atoms etch the surface.

Tiny Counter Finds Uranium

IF YOU hold this midget Geiger counter next to a radium-covered watch dial (left), it will make your earphones click and a neon bulb flash. It will do the same over uranium deposits—and that might mean a $10,000 Government bonus for the lucky prospector.

Powered by standard, easily replaced radio batteries, the counter weighs only two pounds and measures 2¾ by 4½ by 5¾ inches. It indicates the activity of ores by the speed of the clicks and flashes.

The counter shown, made by Nucleonic Corp. of America, Brooklyn, N. Y., sells for $67.50. A simpler model without the flashing light is less expensive.

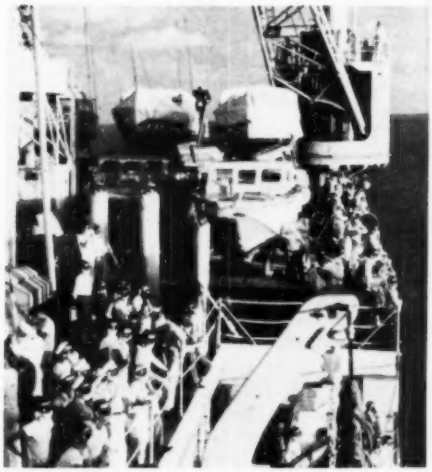
The A-bomb's "signature," the familiar mushroom cloud, is almost hidden in this sunsetlike picture. Eniwetok Atoll, on which explosion occurred, is seen as long thin line below horizon.

Photos of Secret A-Bomb Test

WHAT went on during the hush-hush test of deadlier atom bombs in the spring of 1948? The curtain has been partly lifted with release of these pictures. But the Atomic Energy Commission still won't say more about the bombs themselves than that there were three, "each of improved design," and they all went off. END

These blocks and cable were part of a gadget that collected samples of sea water after explosion.

Concrete "igloo," near detonation point, contained instruments to record data during blast.



Men aboard Navy ship turned backs or shielded eyes with glasses at instant of detonation.

After explosion, helicopter picked up ocean samples from raft attached to water-sample cable.

Hornets Help Atom Engineers

When uranium atoms are split in atomic engines, barium is formed. Hornets collect barium. So nuclear engineers propose to keep hornets around reactors—and detect leaks by checking the hornets periodically for radioactivity.

Mouse Can't Lose an Atom

The mouse in the glass house at right has eaten food containing radioactive carbon. Scientists are following it through his body. This apparatus collects all the air he exhales and all other body excretions.

Kaiser Utility Sedan Converts to Tent

The sedan that converts to a truck now converts to a tent, too. A steel frame and canvas tent fit over the opened deck lid and tail gate of the Kaiser Traveler and Vagabond (PS, April '49, p. 106) to provide quarters for overnight lodging. The waterproof duck and drill tent, which measures 6½ by 6 by 4 feet when open, can be folded or unfolded in two minutes. It is reported to be insect- and vermin-proof.

The photos above show LeRoy Smelker, inventor of the Travel Tent®, attaching the frame to the deck lid and standing beside the erected tent. Available through Kaiser-Frazer dealers, it is made by Allied Cloth Specialties, Inc., of Greenville, Ohio.

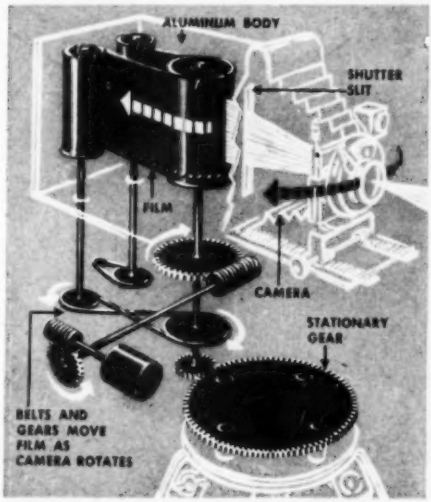
Second-hand and war-surplus materials make up most of 360° camera. Front end is old Autographic Kodak®. Drive motor, film are surplus; leveling table came from a junked transit.

Spinning Camera Covers 360°

A CAMERA that rotates to get a view all around itself on one negative can now simplify map making. It gives a picture 41 inches long and six inches wide—the two ends overlap slightly to complete the circle. Measurements on the picture then permit quick preparation of a fairly accurate map.

Eliminating the difficult task of accurately joining separate photographs made with ordinary equipment, the homemade 360° camera is an adaptation of the old "panorama" camera used to photograph large groups of people. It turns on a large gear that simultaneously moves the film past an exposure slit.

Two students at Rensselaer Polytechnic Institute, Ralph B. Grahl, Jr., and Robert B. Jarvis, designed and made the camera as their master's-degree thesis.



How it works is shown in drawing above. Motor rotates camera around large stationary gear (bottom), thus causing worms, gears, and belts to move film in synchronism past exposure slit.

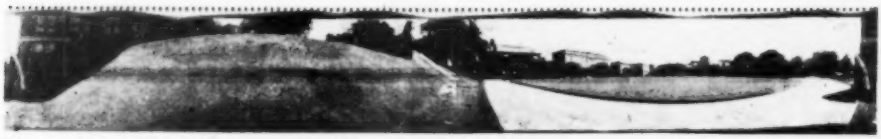
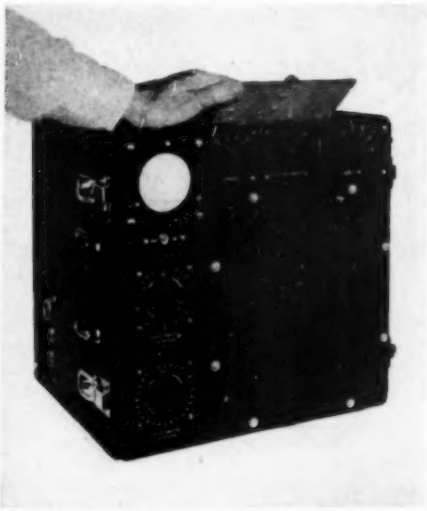


Photo shows Rensselaer campus. Note overlap—building corner, stairs are at both ends.

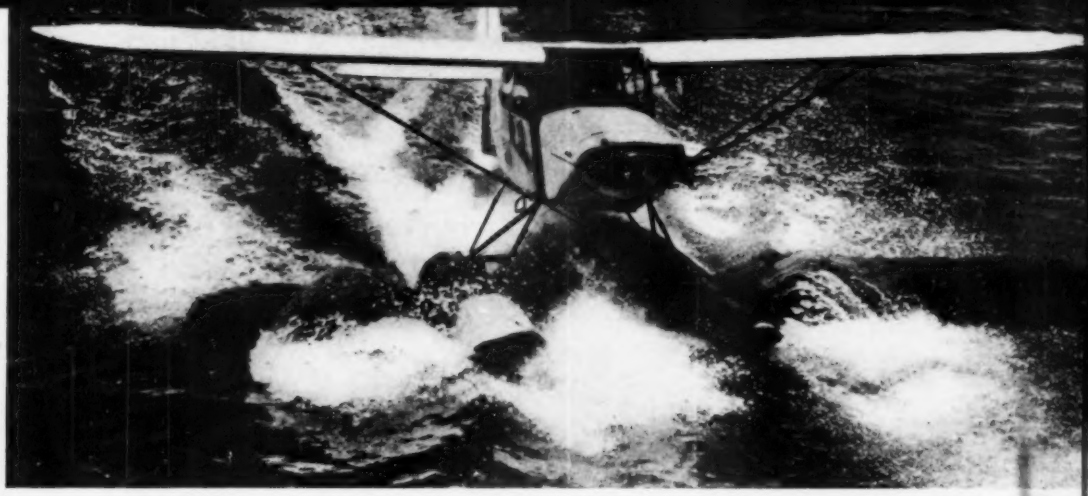
What's New in Aviation

Planes Become Water Babies. The three aircraft pictured above are showing off their newly acquired aquatic ability with a splash. At left, a Convair L-13 makes its first water landing, chalking up another achievement for the Air Force's jack-of-all-trades liaison plane. Next to it, a Sikorsky H-5H, claimed to be the first helicopter with amphibious landing gear, takes off after a sea landing. Developed for the Air Force, it

New Brake Device Stops Skids. Even on icy runways, a plane with a new Boeing attachment shouldn't skid. An electronically controlled valving unit, shown above installed on a main wheel of a Stratofreighter®, opens to cut breaking power a second before the skidding point would be reached. The outside portion, to which the engineer is pointing, is a slotted driving link that engages hub-cover pins. Housing behind it hermetically seals the rest of the device. There is one unit on each of the main wheels.

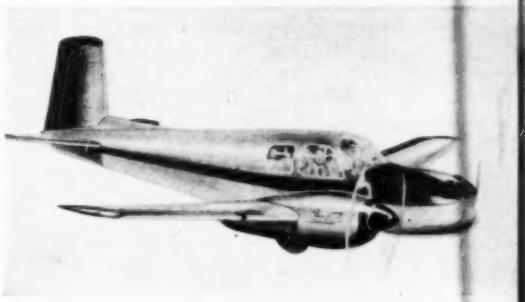


Electronics Spot Engine Fault. A new version of the Sperry airborne engine analyzer (PS, Nov. '47, p. 109), the portable unit above is designed for use by ground crews servicing planes not equipped with the flying model. Made to suit any engine now in airline service, the 41-lb. analyzer detects vibration, detonation, and ignition troubles. Patterns appearing on the oscilloscope at upper left indicate and locate engine failures. It also can be used in engine- and fuel-research projects.

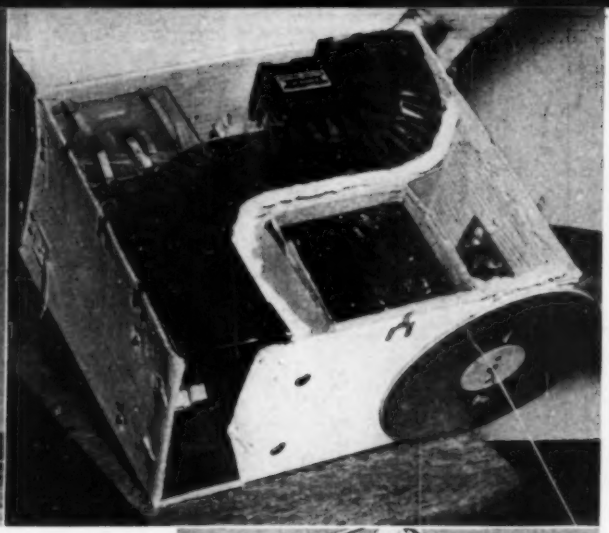


has both floats and wheels, as shown in the photo, making it equally at home afloat or ashore. At far right, the seaplane version of the Piper Clipper® comes in for a water-spray setdown on its Edo floats. A sportman's special, the water Clipper can carry a canoe in sections, an outboard motor, and complete camping equipment for an extended two-man wilderness vacation. Like its landplane companion, it has a 115-hp. engine.

Bonanza Adds an Engine. Artist's sketch at right shows how the Beech Bonanza® will look in its new two-engine version now being built. Although the fuselage and cockpit configurations are similar, the familiar V tail of the single-engine job has given way to a single fin and rudder tail assembly. It is being designed as a five-place airplane, to sell at around $30,000. The engines are reported to be 185-hp. Continentals. The Twin Bonanza, or Model 50 Beechcraft, debut is expected early in 1950.

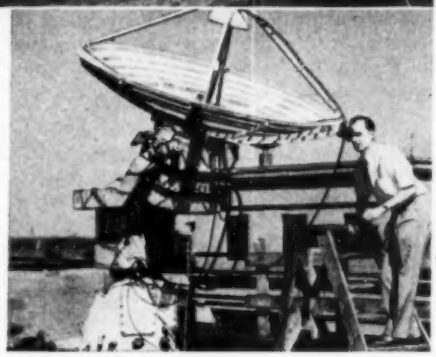


New Navy Giant Built for Speed. When this 60-ton flying boat, the XP5Y-1, takes to the air this fall, Convair engineers predict that it will cruise at 350 m.p.h. With four Allison turboprop engines, it will have more take-off power per pound of aircraft than some modern fighter planes. This isn't guesswork. Radio-controlled models put it through its paces even before construction began (PS, June '49, p. 120).



Flying Box Analyzes Clouds

NAVAL weather observers can now measure the size of clouds and take their temperature—all from the ground. A new GE "Cloud Analyzer" is carried aloft by a balloon (left above). It radios data to ground equipment (right) that records it on moving strips of paper. A salt-saturated string (inside S-shaped duct at right above), whose electrical resistance varies with the moisture it picks up or loses, tells a cloud's height, thickness, and density. Other instruments record temperature, air pressure, humidity.



World's First Jet Air Liner Makes Flight Debut

BRITAIN jumped the global gun in the race for commercial air supremacy with a recent announcement that its giant de Havilland Comet, first all-jet air liner, had made successful flights. After nearly three years under construction in secrecy, the sleek, sweptback-wing craft has been unveiled. Above, it is shown in its first test flight at Hatfield, England. Four Ghost turbojet engines, each developing 5,000-lb. thrust, are designed to give the jet liner a cruising speed of 500 m.p.h. A pressurized cabin will permit it to fly at 40,000 feet. Expected to be in commercial use by 1952, the Comet will carry 36 passengers and a crew of four. Sixteen of the planes are being built.

He isn't going anywhere, and he hasn't had an accident. It's just Hollywood's way of converting a convertible into a three-piece jigsaw puzzle to simplify photographing actors inside the car.

Here's the convertible all together again and ready to drive away—or so it seems on the screen. The camera doesn't show that it has no wheels and no engine under the hood.

Come-Apart Cars Let Camera In

By Louis Hochman

IF YOU didn't look too closely, you'd say that was a neat-looking convertible the movie stars were getting into on the studio lot. But if you looked again two minutes later, after a couple of stagehands got busy with it, you'd wonder why you didn't hear the explosion that blew the car into so many pieces all over the set.

Fact is, the car wasn't blown apart. It was taken apart, section by section, to give the camera an unobstructed view of the performers inside it.

The ingenious car-that-comes-apart is a brainchild of Dick McWhorter, assistant director at Paramount Pictures. When Dick came back from the war to his movie job, he was amazed at how much costly production time studios wasted while prop men improvised mock-up car bodies for interior close-up shots.

For a scene that called for close-ups of actors in a car, prop men would either build a wooden mock-up to order, or hack up an old car body and remove sections that interfered with the camera and lighting angles.

Car splits in two as special leverage clamps are unhooked and the sections pushed apart. Each main section of the come-apart car rests on its own steel frame and rolls away on dolly wheels.

You've got to adjust yourself to the steering wheel of your car, but the movie driver doesn't. As shown above, a bracket allows the steering column to be set at any desired angle.

The mock-up would be mounted high on wooden dollies, necessitating a platform for the actors to walk on. And all too frequently, when the director called "ACTION!" the sound men would tear their hair as the mock-up groaned and squeaked under the actors' movements.

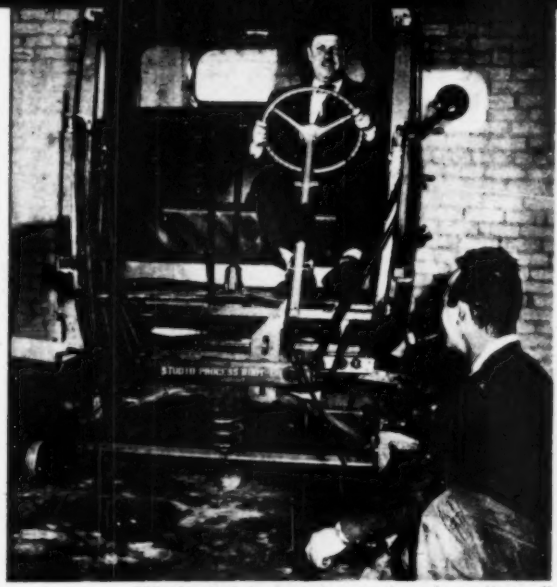
Why, thought McWhorter, couldn't somebody take a regular car body, cut it into convenient sections, and rig it with clamps and fittings so you could take it apart any way you wanted – and reassemble it just as easily?

Testing his hunch, he picked up a wrecked '41 Plymouth at a junk yard and had a welder remodel it into break-away sections. This first model, crude as it was, made such a hit with the studios that he soon founded the Studio Process Body Company, which he runs as a highly profitable sideline with Manager Frank Bettis and Chief "Gismologist" Bill Thompson.

Today, his garage off Hollywood Boulevard houses 10 jigsaw-puzzle cars, a sectional wooden bus, and an ambulance, all in constant demand by movie studios. Not only are they cheaper than the custom-built mock-ups formerly used, but actors and technicians find them easier to work with.

The cars – stock bodies bought without their mechanical innards from automobile manufacturers – are fitted to special steel frames with arched leaf-spring suspension and large steel dolly wheels. This welded frame is designed to support the body at normal car height and give it the same motion as an automobile moving on the street. To simulate bouncing, a stagehand slips a two-by-four under the frame and rocks it on cue.

Squeezing a cameraman into the back of this Dodge truck for a rear-angle interior shot would be the hard way to do it. Removing the entire rear panel as shown below is much simpler.



Filmland driver can't see where he is "going" in relation to projected rear-window movie landscape. So assistant at right steers wheel for him with crank to insure correct turns of wheel.

The moving landscape seen through the windows is really a movie projected on a translucent "process" screen behind the car.

Most of the cars fall apart into three main sections, which in turn come apart into as many as 20 to 25 pieces. Steel roofs are cut up into removable panels to let light and microphones come in from above. Doors lift neatly off their hinges for side-angle shots.

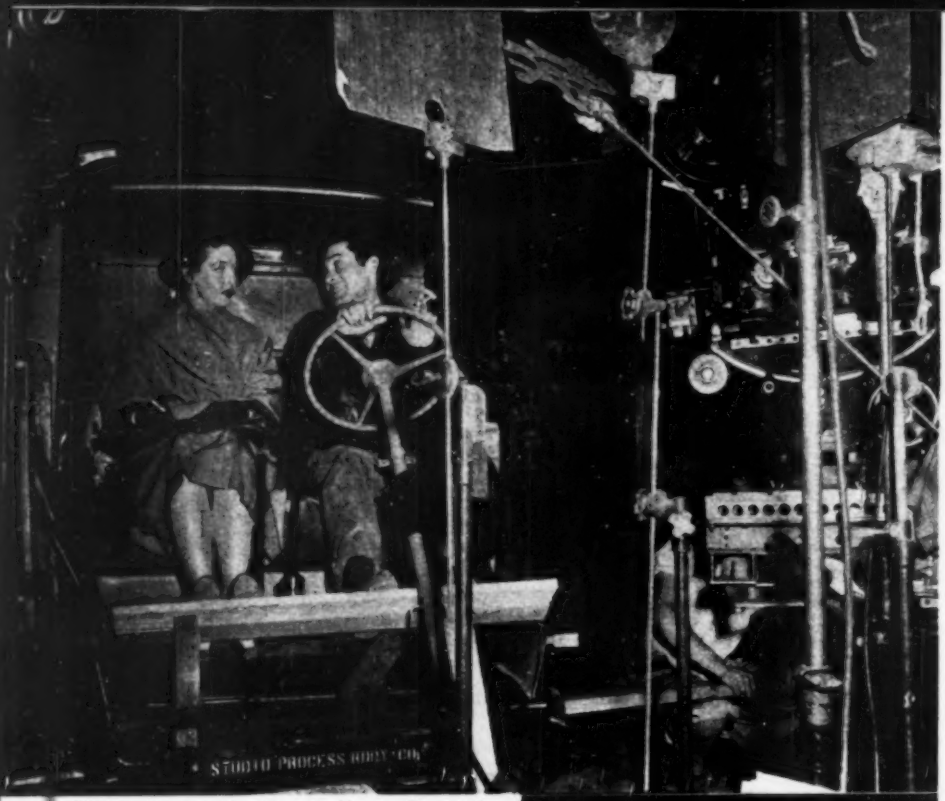
For front views, hood, windshield, and cowling separate from the rest of the body, leaving the front seat and the driver exposed to the camera. Since the doors and steering wheel show in this angle, they are held on by special brackets that even permit them to function normally. But the actor at the wheel can't see the landscape receding on the process screen behind him and doesn't know which way to steer. So he merely holds the wheel loosely and lets a stagehand do the steering by remote control—a long crank handle attached to the base of the steering post.

To let the camera shoot through the windshield, all glass can be slid out of the frame, giving clearer pictures of the people inside. Or maybe you want a driver's-eye view? The entire rear half of the car can be detached and rolled away.

Falling apart in the right place at the right time does not exhaust the tricks possible with these movie cars. Although Studio Process has only 10 complete car bodies in stock, those 10 can be made to represent almost any make or model needed.

There's an ingeniously designed 1949 Buick sedan that can assume nearly any name from Ford to Cadillac, simply by switching a few of its parts. A '48 Dodge sedan is changed into a Chrysler Town and Country® by replacing its doors with wooden station-wagon doors that have been cut down to fit. Substitute small cabbie seats and a glass par-

There are lots of tricks to the jigsaw-puzzle cars. Below, a snub-nosed front converts a truck into a cab-over-engine model. Interchanging parts make it possible for one car to play many roles. With slight but ingenious changes, a 1949 Buick sedan can double for a Ford, Mercury, Lincoln, Cadillac, Oldsmobile, Chevrolet, Pontiac, Kaiser, Frazer, or Dodge.



Mickey Knox takes Loretta Young for a ride during filming of *The Accused*. Man well concealed by movie camera and lights at far right uses a plank as a lever to bounce the truck on cue from the director. Photo at lower right shows how the scene appears to you on the screen.

tition for the front seat of a '41 Plymouth and—presto!—it's a Yellow Cab. Even a truck body can be regular style or cab-over-engine, depending on which hood is hooked on.

Each main section of a come-apart car sits on its own steel frame and rolls away on a dolly. When brought together, the sections center themselves and slide snugly into place on disappearing doll pins. Specially designed leverage clamps that work on the same principle as trunk catches pull the sections tightly together and automatically lock them in place.

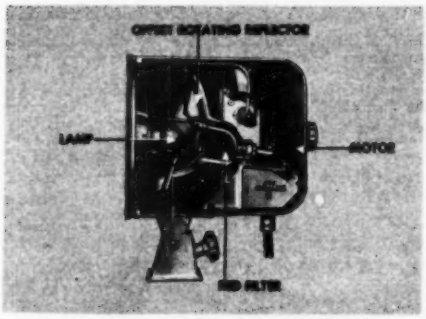
Because of the strange alterations these car bodies undergo, practically every hook, clamp, screw, and bracket has to be made by hand. All this complicated work is done in a small corner section of the shop.

Here, "Gismologist" Thompson goes to work on stock car bodies with an acetylene torch, cutting them into sections, smoothing and upholstering the rough ends, and fitting them with disappearing doll pins and leverage clamps. To obtain a satin finish—better photographically than the customary high gloss—Thompson has a trick of mixing his paints and spraying them on from just the right distance so that the spray is partially dry by the time it hits the surface.

Started in September of 1946, the business has flourished nicely in its short three-year life. The jigsaw-puzzle cars have appeared in more than 100 films, the more recent ones being *Criss Cross, The Accused, Race Street, A Crooked Way,* and *Bitter Victory.* END

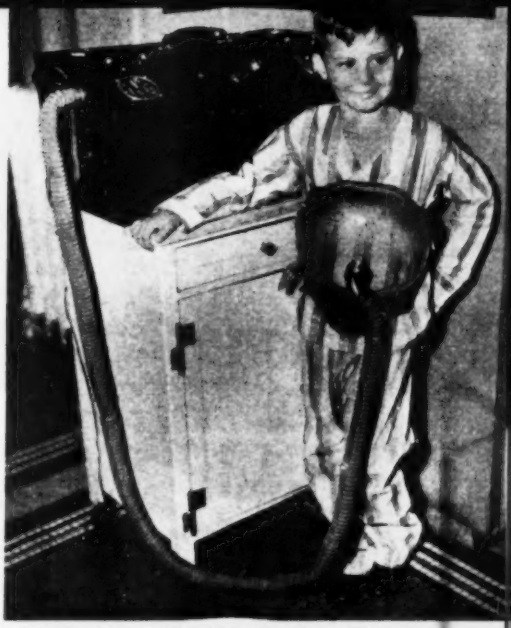
Watch Tells Tide Time

THIS Swiss-made chronograph tells tides as well as time. Once set to the tide schedule of any seaport, it shows the rise and fall of tides at that point on two small dials (left and right), one for high tide and one for low. It automatically advances the time of the tides twice a day—about 25 minutes every 12 hours—as the tides themselves advance. Designed for fishermen and sportsmen, it also offers stop-watch, elapsed-time, time-out, and other chronograph features. Called the Seafarer®, it's sold by Abercrombie & Fitch, New York City, for $96.



Locomotive Light Looks 3 Ways

THIS new emergency light for locomotives rolls its eye to warn motorists and other trains. A single, offset reflector, rotated by a small motor, gives its 650,000-candle-power beam a gyrating motion for greater attention. This white light is used as an extra warning to motorists at grade crossings. When the train makes a sudden stop, a red filter slides over the lamp, and the light shines a red beam to warn approaching trains. And with the reflector kept stationary, the white beam can serve as an emergency headlight. The three-way light is made by the Pyle-National Co.



"Iron Lung" Weighs One Pound

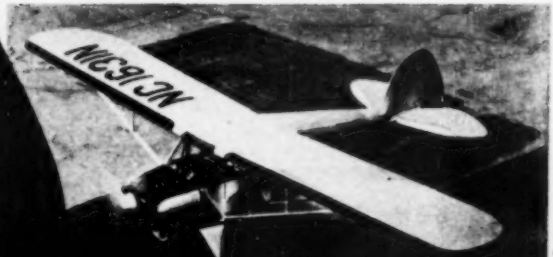
RECUPERATING polio patients are freer to move around when wearing this one-pound "iron lung." Called the Monaghan® respirator, it consists of a rubber-plastic chest plate connected to an electric pump by a seven-foot hose. The pump creates an intermittent vacuum in the chest plate, causing the patient's lungs to draw in air. The respirator works on battery or house current and can be regulated to suit the patient's breathing rate.

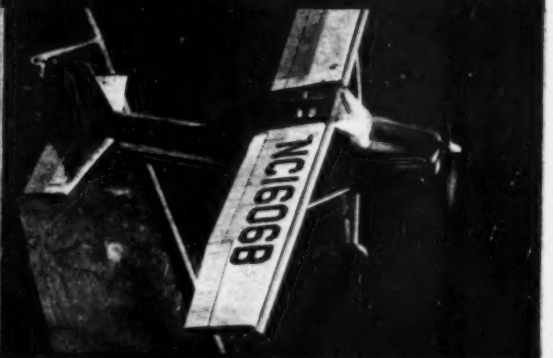
Paper Keeps Rust off Machinery

IRON and steel machinery parts wrapped in this Nox-Rust Vapor Wrapper® can be stored from three to five years without rusting. Used like ordinary wrapping paper, it is impregnated with a chemical that slowly vaporizes, creating an atmosphere that prevents corrosion even in the presence of moisture. Made by Nox-Rust Chemical Corp., Chicago, it is said to eliminate the need for special coatings and containers.

How's Your Plane IQ?

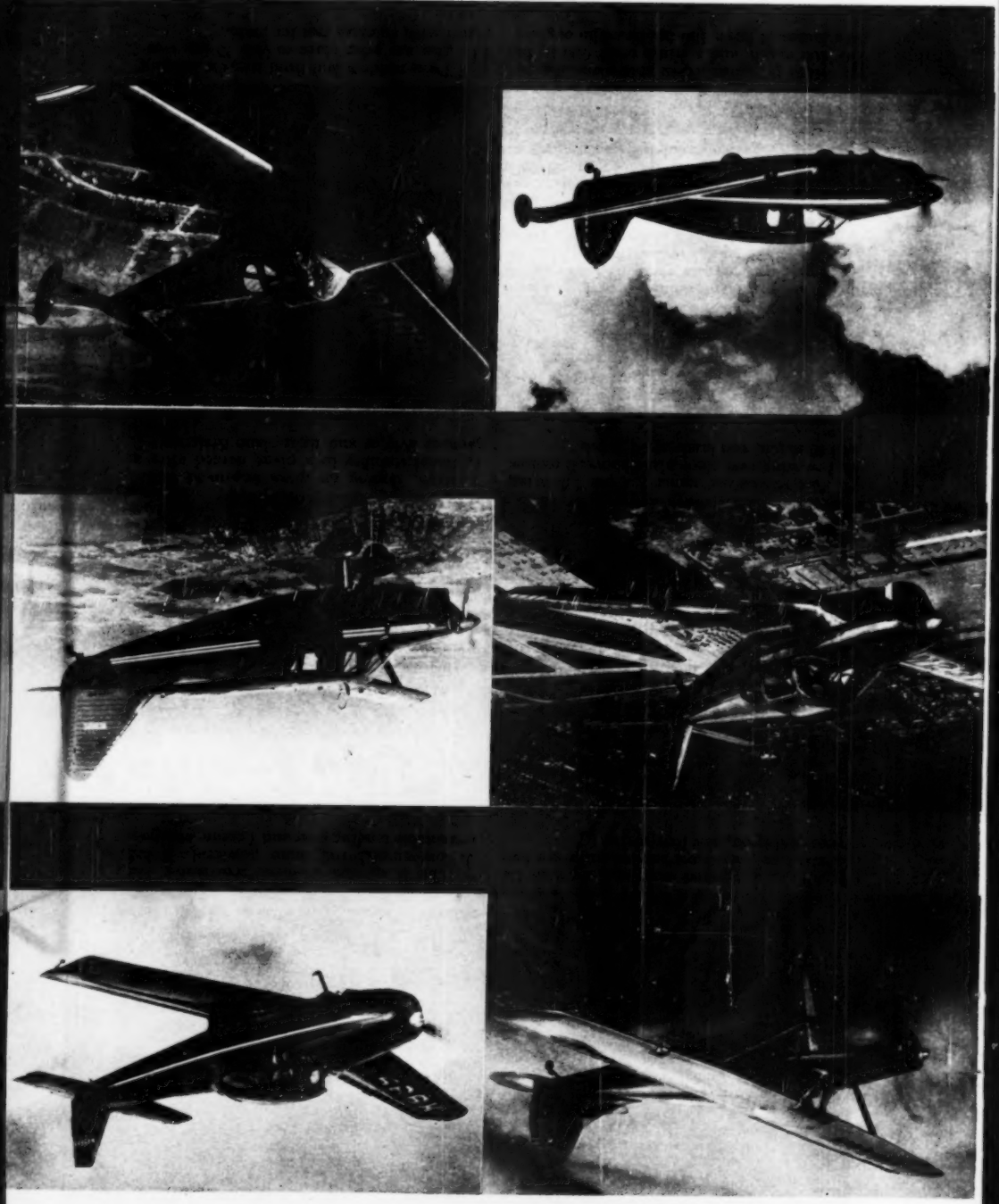
You've probably seen most of these personal planes buzzing around your local airport. See how many you can identify, then check the answers printed upside down across the bottom of these pages.





7. Stinson '49@; 8. Beechcraft Bonanza@; 9. Aeronca Sedan; 10. Bellanca Cruisair@; 11. Club-Air Ercoupe@

1. Funk Customaire®; 2. Cessna 170®; 3. Ryan Navion®; 4. Piper Clipper®; 5. Silvaire® Sedan; 6. Temco Swift®;



First step in porcelain enameling is processing the glass. Molten glass from the crucible is poured into cold water, which chills it so fast it shatters into millions of small particles called "frit."

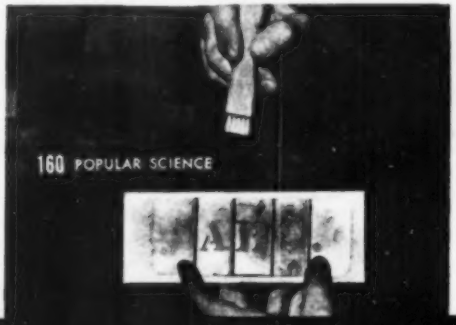
Table-Top Porcelain Plant

A FACTORY that fits on a table top shows how your porcelain-enameled refrigerator got its glassy finish. It demonstrates the steps by which glass is powdered, then fused onto a metal base, forming a hard, easily cleaned, decorative surface. Dr. M. J. Bahnsen, research director for Ferro Enamel Corp., Cleveland, developed the miniature plant. It's used to boost sales of enamel-manufacturing equipment and supplies.

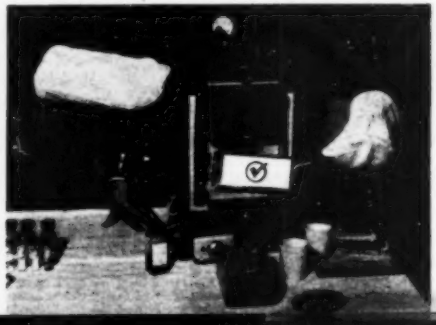
Beakerful of frit (right hand) is ground in porcelain-lined ball mill (left hand), with clay, water, and ceramic pigments. The result is a thick, creamy mixture known as "slip."

Metal panel to be enameled is dipped in the slip mixture. (This may also be sprayed on.) It then gets a preliminary drying in the furnace, leaving a dull, claylike finish.

Before final baking, identifying marks or decorations may easily be stenciled on. These become a permanent part of the finish. Another coat of powdered frit is then applied.



Metal is then fired in a miniature electric furnace at temperatures of 1,500-1,600° F. Heat melts the frit coating, fuses it to metal backing as a permanent, glass-hard coating.



Huge Model Shows Steel-Making

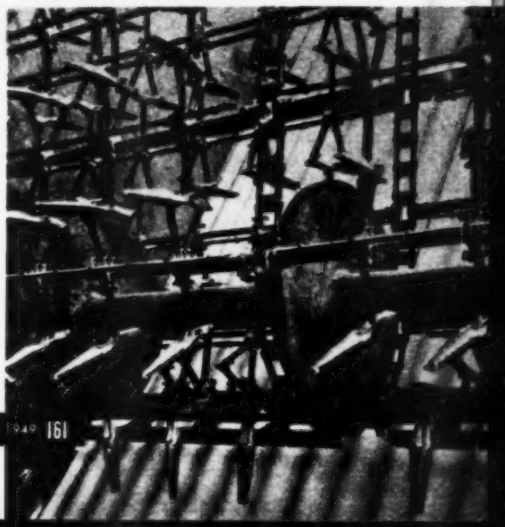
If this model steel mill were life-size, it could turn out 10,000 tons of steel a week. Although built to a scale of one inch to six feet, the miniature plant covers the area of a tennis court. It shows every step in steel production from ore boat to finished metal—and everything works. British Iron and Steel Federation showed it in London.

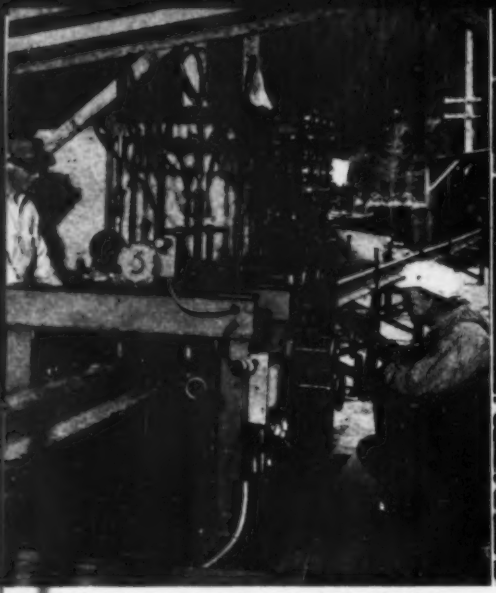
Mike Dampens Dog's Bark

This device really dampens your dog's enthusiasm for baying at the moon. A microphone, amplifier, and valve combine to squirt water at the dog if he barks. He soon catches on, says W. J. McGoldrick, Minneapolis-Honeywell engineer, who tried it on his dog.

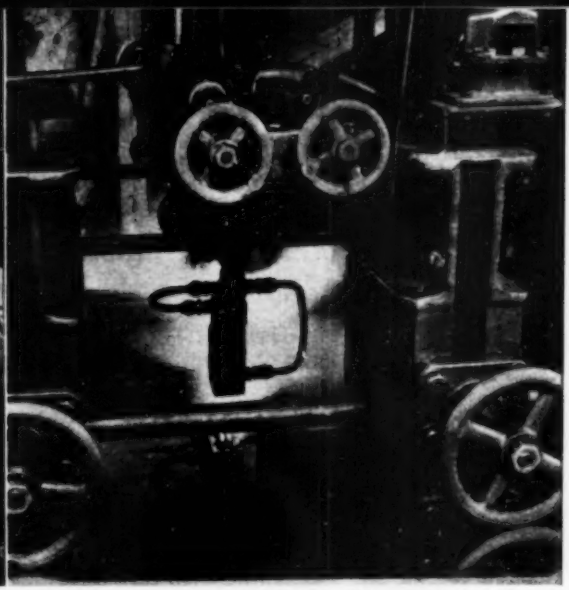
Steel Fingers Harvest Hops

A new machine harvests hops as fast as 300 handworkers. Moving hooks pull the vines past steel fingers (below) that knock off the fruit. Stems and leaves are vacuumed away. Rubery, Owens & Co., Ltd., of London, makes the harvester.





Rail ends are squared up, washed with ethylene dichloride, and polished. This Oxweld® machine then fuses them under 2,500-lb. pressure at 2,300° F. Five minutes of this does the trick.



Close-up shows a few of the 125 welding tips that join the 39-foot rail lengths. After welding, joints are trimmed, ground, and polished to a velvety smoothness by a series of machines.

4-Mile Rails Save Work In Tunnel

TRAIN passengers riding through the Great Northern's Cascade Tunnel at Scenic, Wash., no longer hear the familiar clickety-clack of the wheels over rail joints. Continuous rail, pressure-welded on a special assembly line, has eliminated conventional joints over four of the tunnel's 7.79 miles.

Longer service life and reduced maintenance costs are expected to repay the $189,000 laid out for the project. No joints means no pounding of rail ends by wheels. On ordinary track, these impacts flatten rails, weaken joints, beat down the roadbed, and chew up ties. In the cramped quarters of the single-track tunnel, longest in the Western Hemisphere, repair can be a bottleneck.

The assembly line pictured here, at the west portal of the tunnel, last summer rolled out 1,300 feet of rail per day. Flatcars hauled the sections into the tunnel, where they were spiked down and the remaining joints hand-welded.

The heavy steel flexes easily around four-degree curve. Flatcars can handle up to 12 rails simultaneously, but only three are loaded since narrow tunnel restricts train movement.

Finished joints are dusted with Magna-Flux® powder and checked with electromagnetic testing unit. Pattern created in the powder shows up flaws invisible to the naked eye.

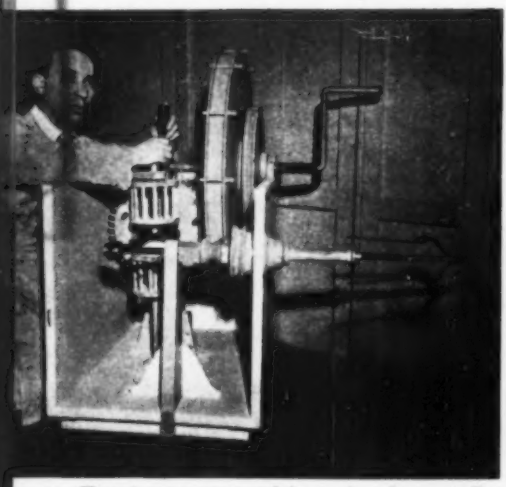
Lengths of welded rail are loaded with help of rollers on string of 25 flatcars. Worker tightens a clamp near center of 1,300-foot section to prevent lateral shifting during ride into tunnel.

To unload, rail is clamped to anchored steel cable at tunnel's end. Cars are then pulled from under it, the rail slipping easily over the rollers. Section gang waits at the right to move in, spike the rails to the ties, and hand-weld the joints between lengths. Next year the remaining 3.79 miles of rail in the tunnel will get the same treatment, according to present plans.

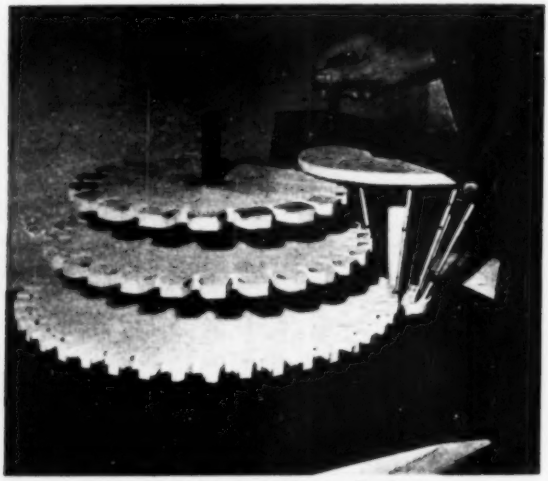
Of the many types of bridges designed by da Vinci, the rotating cantilever model shown above was one of his most important contributions to the defense of a military position. Intended to connect an island fortress with the mainland, the bridge could be swung away when not in use. Its construction principles are still in use by bridge builders today.

Leonardo Comes to Life

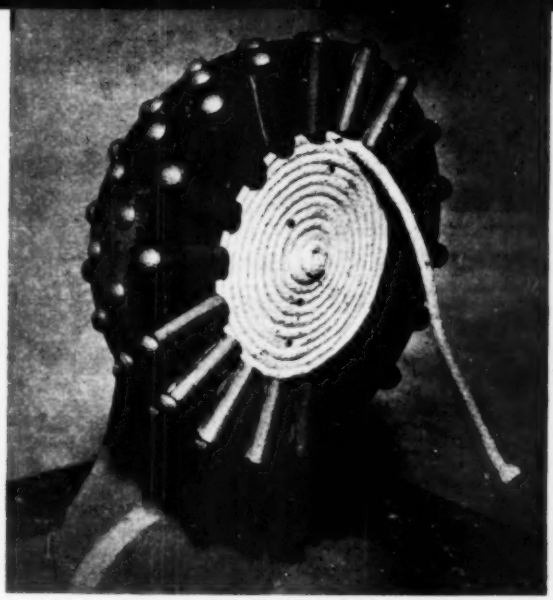
IF POPULAR SCIENCE had been published some 450 years ago, it undoubtedly would have carried these items in its "New Ideas from the Inventors" section. A three-speed power transmission, a form of which you use in your car every day, is but one of



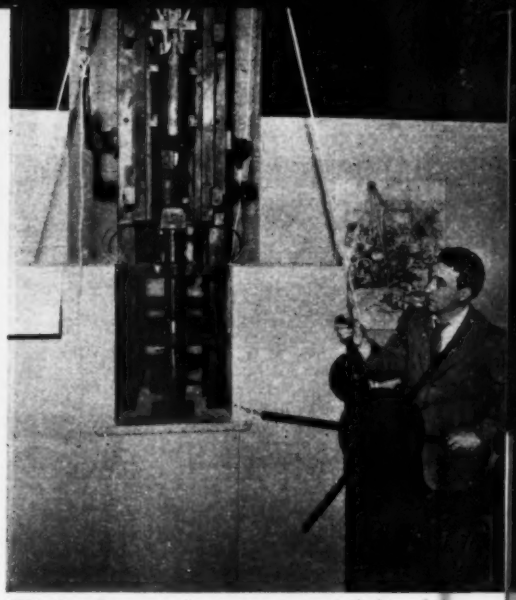
Here is an ancestor of the modern flyer spindle. A complicated arrangement of gears enables an operator turning handle at upper right to wind thread smoothly on revolving spool below it.



The variable-speed drive can be credited to Leonardo. As shown here, he meshed three cogged wheels of different diameters with one central (lantern) wheel, seen being turned at right.



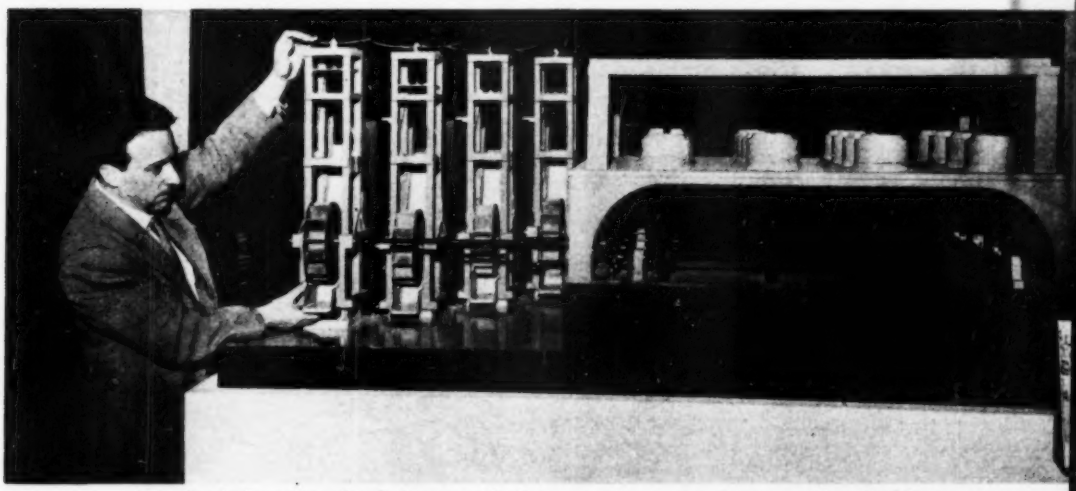
A forerunner of shrapnel, this aerial projectile was one of his many military weapons. When coiled fuse burned down, the disk exploded, scattering the bullet-like spokes embedded in it.



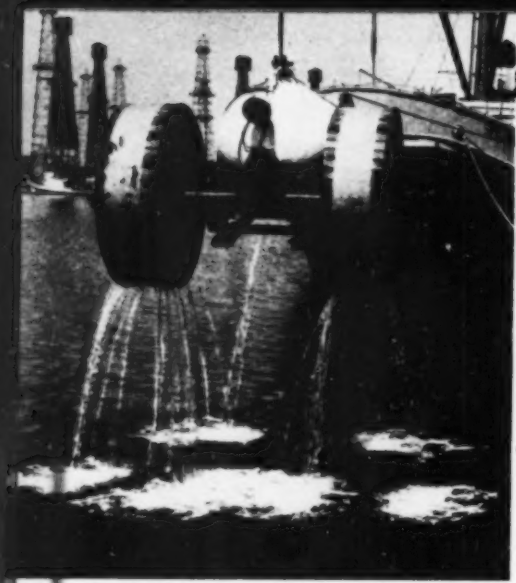
This hand-operated minting press is believed to be the first to stamp both sides of a coin simultaneously. Weight, shown being raised, is released by the plierlike device seen at top.

the more than 300 machines, weapons, and other inventions designed by Leonardo da Vinci, famous 15th-Century Italian artist.

Now 66 of these have been re-created by Roberto A. Guatelli, an Italian-born mechanical engineer, in faithful counterparts of the originals. These models not only illustrate mechanical principles discovered or adapted by Leonardo; they actually operate. Working in the Los Angeles County Museum from the old sketches, Guatelli built his re-creations mostly of hard wood. END



A mechanical version of today's massive hydroelectric plants is the da Vinci grinding mill shown above. A set of grinding machines, seen at right, was placed on each bank of a swiftly moving stream. Power was furnished by a series of water wheels, shown at left, located in midstream and connected to the grinding weights by a system of shafts and gears.



Barton's benthoscope is hauled up by cable after 340-ft. test dive at Long Beach, Calif. Two powerful, externally mounted searchlights give illumination within a radius of 10 feet.

Artist's conception at right shows fish's-eye view of ocean-floor explorer in action. Main wheels are old cable drums.

Ocean-Bottom Cart Explores New World

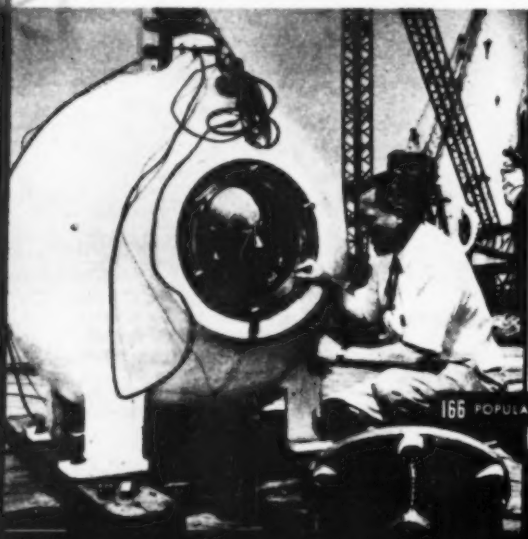
OTIS BARTON, New York scientist, likes to get to the bottom of things. This time it is the Pacific Ocean off the California coast. He hoped to sink himself below its waves to twice the 3,028-foot depth he reached off Bermuda in 1934. That was in the famed bathysphere he built for William Beebe.

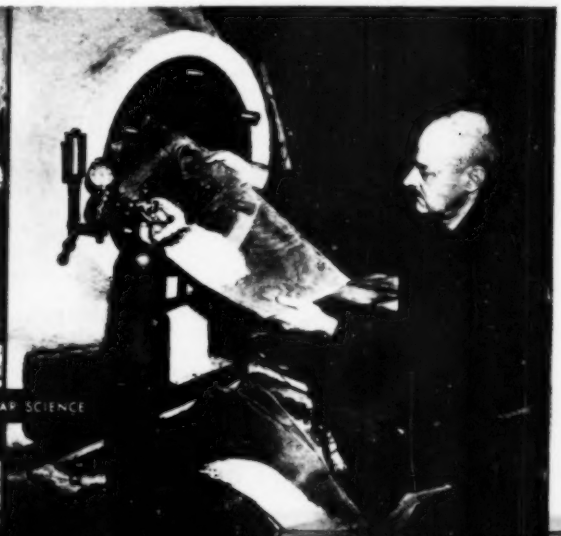
His new vehicle is a thicker-shelled, hollow, two-man steel ball mounted on three huge, wide-tread, wooden wheels. His ocean-bottom trailer is towed by a ship, enabling him leisurely to study strange marine life and undersea canyons.

Called a benthoscope—meaning "view of the ocean depths"—Barton's oceanic crawler already has come through "wet runs" at 40 feet. The project is sponsored by the Hancock Foundation for Scientific Research of the University of Southern California. If the Pacific perambulations were successful, Barton saw no reason why he couldn't roll his way across the "not-so-deep" Atlantic.

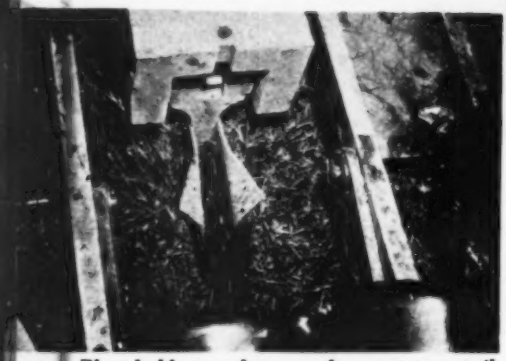
There's not too much room for Barton, seen below peering through port of his 52-in. diameter sphere. It is made of chrome-nickel steel 1⅜ in. thick, and has two fused-quartz windows.

Breathing in the benthoscope is a problem. Below, the inventor is loading trays of soda lime that absorb carbon dioxide exhaled by the occupants. Tank at left holds 16-hr. oxygen supply.





Operator puts trees from side box into trench.



Plow holds trench open, does not turn soil.

Wheels (under seat) pack soil around roots.

Sled Plants 1,000 Trees an Hour

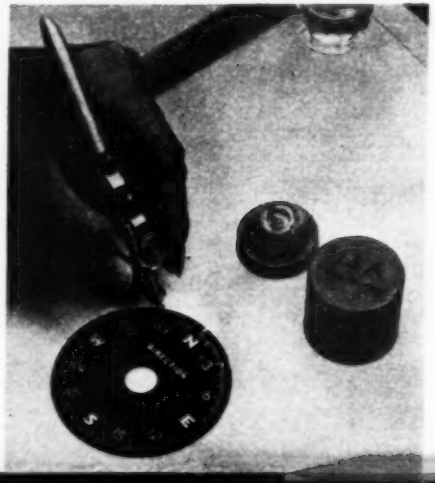
A THOUSAND trees an hour can be planted with the help of a small steel sled that digs a narrow trench, holds it open long enough for the seedling to be inserted, then closes it and packs the earth around the seedling's roots. Designed particularly for use in the Northeast, the TreeP® has a special cutter for slitting stony soil, a larger one for other types of soil. Retractable front wheels are used for towing the sled between jobs.

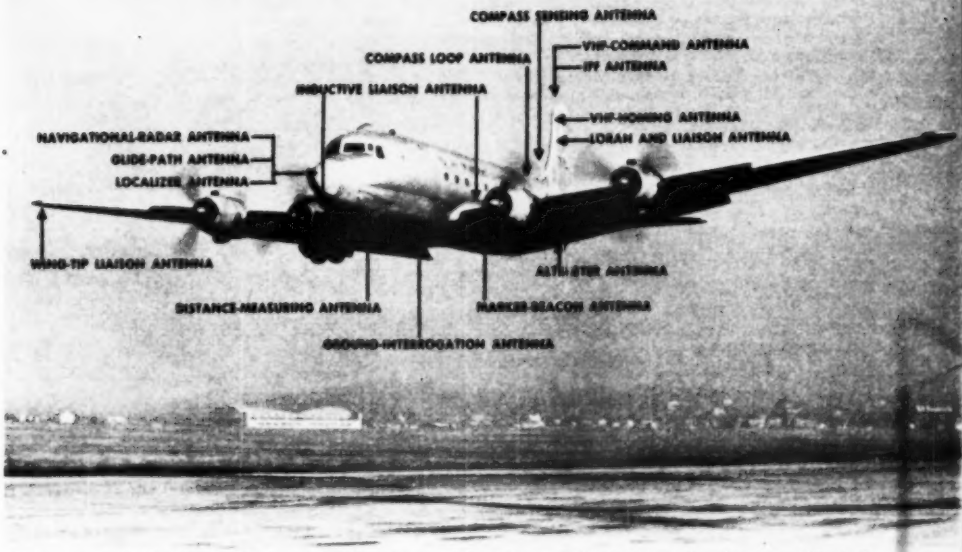
"Landing Gear" Adjusts Trailer

WHEEL units that retract like the landing gear of an airplane permit this trailer to adjust itself to the height of a loading dock. A small gasoline engine powers the hydraulic mechanism – visible through door in photo above–that raises and lowers the wheels as much as 53 inches. Each wheel unit works independently of the other. A. M. Meldrum (above), San Francisco, invented the Hi-Lo Trailer® after two years of experimentation.

Hypo Needle Paints Dials

THIS hypodermic needle squirts paint. It is used to letter dials – such as the compass dial shown below–with luminous paint. E. L. Bermuda, of the Air Force Depot at San Bernardino, Calif., made the device by fitting a sawed-off hypo needle to a steel cylinder and plunger. He reports it's easier and faster to use for fine work than a brush.





There are 16 hidden or flush-mounted antennas in this Air Materiel Command's C-54 flying laboratory, used to test new developments. Buried, the antennas add nothing to aerodynamic drag.

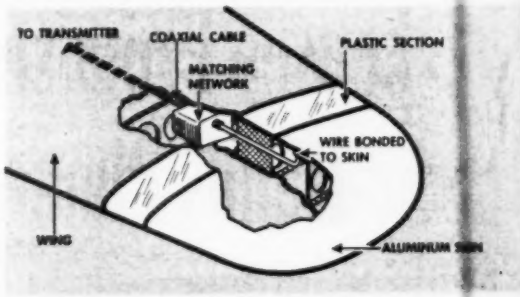
Antennas Go Into Hiding

RADIO and radar devices have been added to airplanes so rapidly that with the accompanying exterior antennas the planes were beginning to look like flying porcupines. And in their other role, as gremlins, the antennas were acting as brakes on the high speeds the Air Force was aiming at.

As one radio expert put it, "When they take the propellers off, then we'll take off the antennas." Along came jet propulsion, and, true to his prediction, the experts are burying the antennas to give the speed-of-sound-nudging planes clean-swept exteriors.

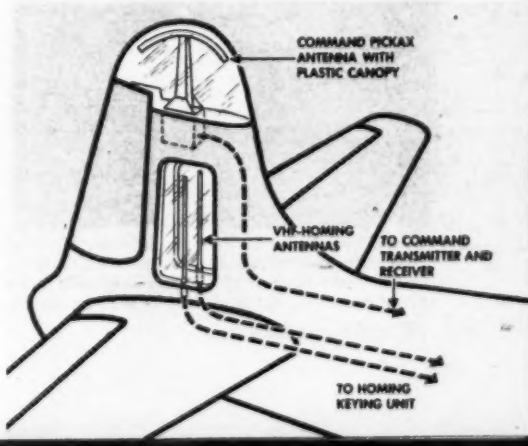
As an example, figures compiled for only nine of the 16 hidden antennas on the experimental C-54 at the top of this page show that these antennas, if mounted externally, would use up 634 hp. at 600 m.p.h. That's enough horsepower to pull half a dozen automobiles.

Among the other advantages of buried antennas are the elimination of icing dangers, added protection against precipitation static, the sealing out of moisture, and freedom from the threat of aerials breaking off at high speeds and interrupting communications.



A zero-drag antenna, buried in a wing tip, is shown in the above drawing. Plastic section isolates tip from rest of wing. If necessary, plane's entire wing can be used as an antenna.

Pickax antenna shown at top of drawing below was the first type of hidden antenna. Designed to follow conventional curve of plane's tail, it is protected by a plastic canopy.

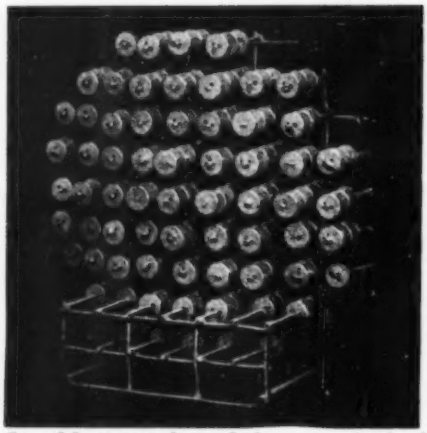


Telephone of the future? POPULAR SCIENCE artist's conception shows phone made possible by new sound lenses. You wouldn't have to pick up the handset—just talk and listen to the black box.

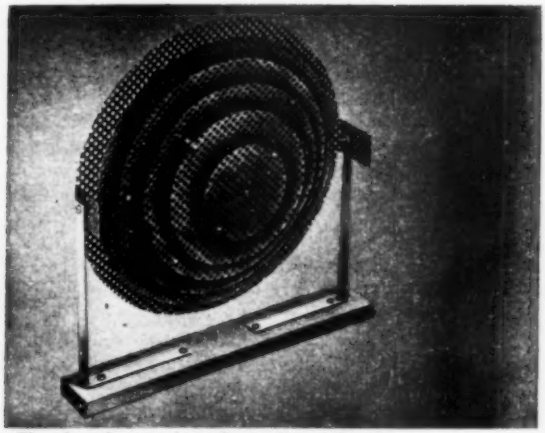
Lenses Promise No-Hands Phone

BEING a good engineer, Dr. Winston E. Kock is a lazy man. He thinks it's too much trouble to lift up a handset every time you want to talk over the telephone. His idea of a telephone is a little black box you never touch—just talk and listen to.

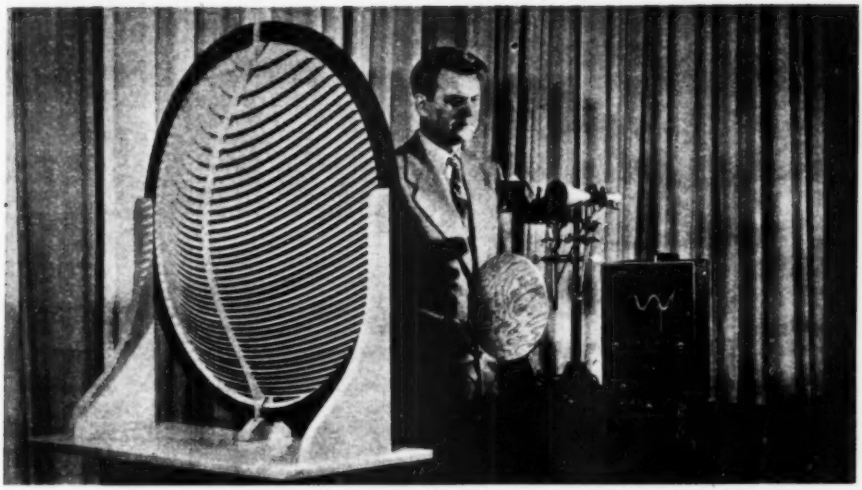
Since Dr. Kock is a physicist-engineer for Bell Telephone Laboratories, he did something about his idea. He developed lenses that focus sound, a necessary preliminary to the lazy-man's telephone. The telephone it-



Sound lenses can be made from many kinds of materials. The one above consists of metal disks on an open framework. It was originally built for microwaves, but works just as well for sound.



Circular sheets of perforated metal make another type of acoustic lens. This particular model, however, cannot be used to focus microwaves, which are reflected by the metal sheets.

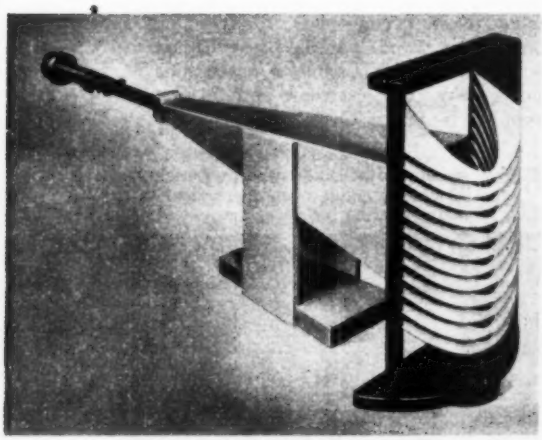


Microwave ancestry of sound lenses is shown by using one lens to focus both types of waves.

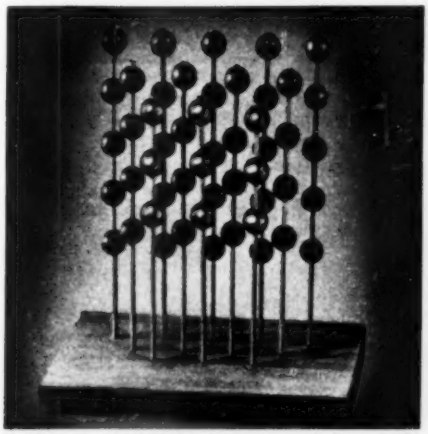
self is still only an idea, but the lenses have been made and should have many uses.

You can understand why lenses are necessary if you've ever held an old-fashioned telephone receiver near the transmitter. The transmitter picks up the receiver's sound, which keeps going around the circuit until it is a howl. A lens would direct the receiver's sound at the user and keep it away from the transmitter. ("Intercom" systems do have combination receiver-transmitters, but you must press a switch to talk—more work than holding a handset.)

The sound lenses grew out of Dr. Kock's research on lenses for microwave radio relays (PS, Aug. '46, p. 90). A little figuring showed that sound and microwaves have the same wavelengths (although they are very different otherwise); so they should be focused by the same lenses. And they are, as Dr. Kock proves by sending both through the same lens, as shown at the top of this page. END



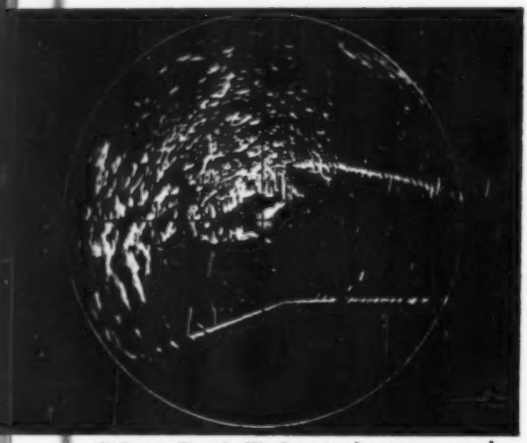
Spreading high-pitched musical notes from single speaker may be use of lens. Since high frequencies are directional, good radios now must use two "tweeters" to distribute music.



Balls are used for this lens. Acoustic lens works just like optical kind: difference in thickness between edge and middle slows some waves more than others, making them focus at a point.

1 **Radar tower** and pilot station landmark outer harbor at Long Beach, Calif. Scanner is located on top of the 122-foot steel structure.

2 **Position of an incoming ship** is being plotted on a harbor-area chart. The port makes no extra charge for the radar-piloting service.



3 **Long Beach Harbor** is shown on a radar viewing scope. Line across bottom is breakwater. Elongated pips are ships; dots are buoys.

Radar Talks Ships into Port

TAKING a tip from aviation, the Port of Long Beach, Calif., has installed a radar system to guide ships safely into and out of the harbor in even the foggiest weather. It works much like the Ground Control Approach radar system by which an airplane pilot is "talked down" to an airport runway.

The harbor pilot is radar-guided to a ship, which he then boards and maneuvers in, obeying instructions sent from a shore station where the ship's course is constantly followed on a radar scope. The new system, first in America, makes it possible to locate ships 30 miles away. The electronic equipment was supplied by Sperry Gyroscope.

4 **Equipped with walkie-talkie,** the harbor pilot is directed to the ship he will guide in. Note the special reflector on top of the launch.

5 **The harbor pilot** takes over in the ship's wheelhouse. Listening to the shore radar station, he relays steering orders to the helmsman.

"Carfeteria" Serves Motorists at Wheel

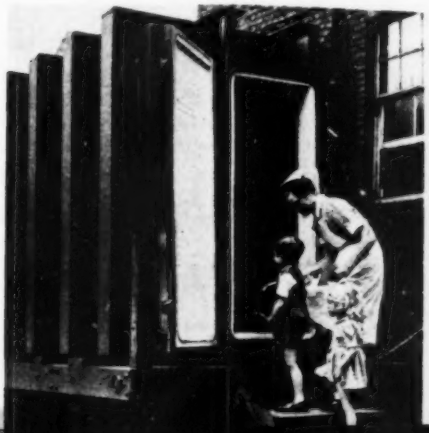
EATING is made easy for motorists who patronize the wheellike Los Angeles Motormat shown above. Spokes of the wheel are tracks along which run small carriages. You drive into one of the 20 stalls, where a carriage and menu are waiting, make your selection, write the order, and press a button. Presto! the carriage whizzes into the kitchen, stopping along the way only long enough for an attendant to figure the cost. In a few minutes the meal is shot back to your car. When you have finished eating from a lap tray, you put the empty dishes back in the carriage—plus the price of the meal.

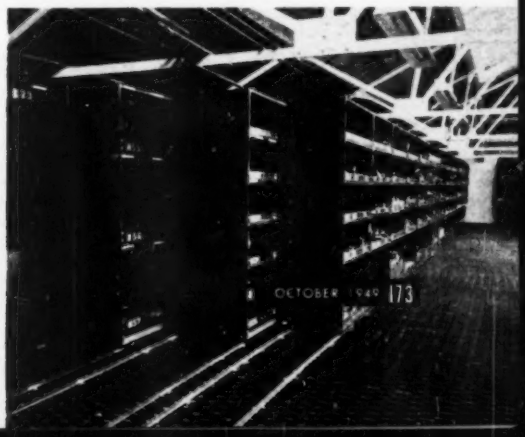
"Flight" Chamber Fights Disease

DURING the war British pilots used the decompression chamber to check the effects of breathing at high altitudes. Now it is being used by their children in a war against whooping cough. Small fry suffering from the disease enter the mobile chamber below, where pressure is gradually reduced to the equivalent of that at 12,000 feet. This lowered pressure permits congested lungs to breathe more deeply, speeding recovery. The new treatment, it is believed, may cut recovery time from weeks to a few days.

Mobile Bins Save Space

WASTED aisle space has been eliminated by a new British system of metal cabinets and lockers that roll on tracks. The rows of storage bins below hug each other for maximum space use but can easily be pushed aside for access to the sections in back. Sliding on ball-bearing wheels, the cabinets move easily and noiselessly. It is claimed that the Foulkes Rolstore Mobile Storage® system saves 20 percent in walking distance. Acrow, Inc., of Newark, N. J., is introducing the units in the United States.





Smooth curves in wood body of this Ford station wagon were made permanent by heat-bonding plywood with radio waves. In background, logs for wood roll into Iron Mountain, Mich., plant.

Radio Toasts Wood Sandwiches for Car Bodies

Dielectric bonding cures glue between plywood sheets in a fraction of the time required by older processes.

EVER wonder how those smooth curves on station-wagon bodies got that way? The Ford Motor Co. uses radio waves to turn the trick. The radio treatment sticks together plywood sheets for the panels and posts in less time than it takes to tell about it.

This method is called dielectric bonding. High-frequency radio waves of about 13 megacycles—one of the frequencies used in short-wave radio—are shot through the layers of wood. Those flowing body curves on Ford and Mercury station wagons result.

When the radio waves, produced by a high-frequency generator, pass through the wood, they set its molecules in motion. The resulting friction between the molecules produces heat that cures the glue between the plywood layers in four to five minutes. Some 350 to 375 pounds of hydraulic pressure per square inch help speed up the process. The waves-plus-pressure combination raises the wood at the glue line to about 280° F.

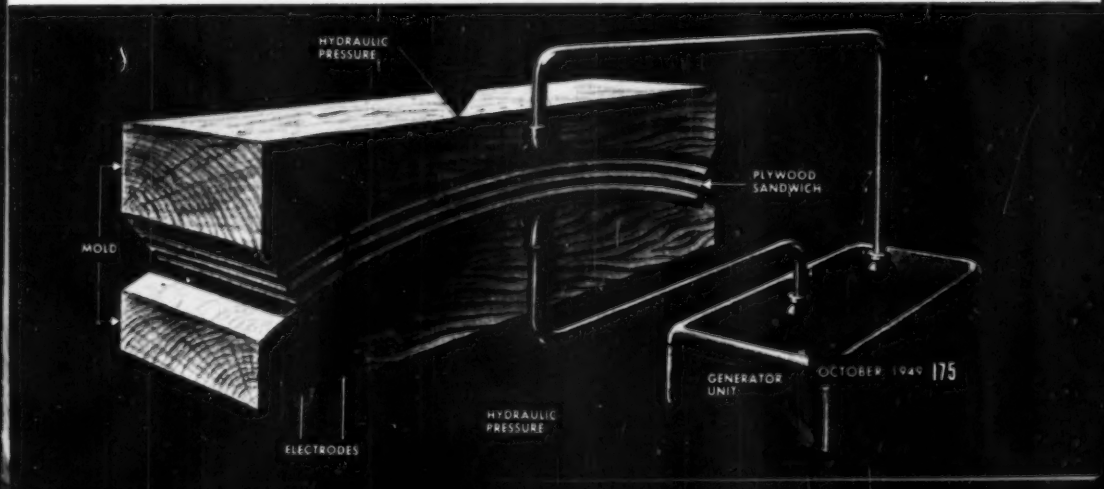
Raw plywood veneer is first checked for moisture content, which must be just right, by instrument that pricks wood, measures electrical conductivity, records amount on sensitive meter.

Radio waves for heat bonding are produced by this high-frequency generator, an oscillator tube with a tuned circuit consisting of coil and condenser. Fins around edge are for air-cooling.

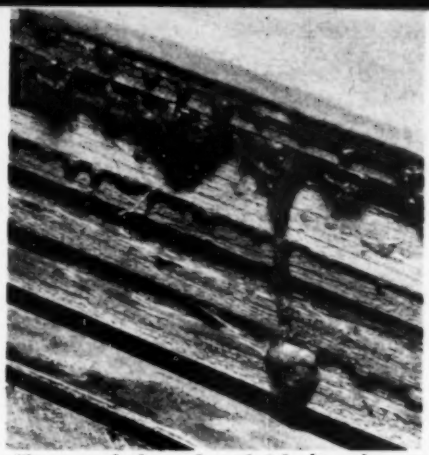
Double-roller spreaders apply glue, a special phenolic-resin type, to veneer sheets after they have been cut to size by rotary cutter. Narrow strip above will form part of door-frame pillar.

Loosely stacked, glued "sandwich" of veneer sheets for door-frame pillar now goes to forming mold. Pressure of 350 to 375 lb. per sq. in. will be applied hydraulically from above and below.

Drawing below shows how two halves of heavy mold squeeze plywood sandwich between them under hydraulic pressure while high-frequency radio waves are shot in to cure glue. Copper electrodes, connected to wave generator, run along top and bottom of mold next to wood.



Here workman removes guides around mold before applying current. He will then pull down copper shield, enclosing mold, to prevent harmful radiation. Molds are made of wood to provide good insulation against loss of heat and energy.



Close-up of plywood sandwich shows how excess glue has bubbled out along edge during heat-and-pressure process. Glue is cured in 4 to 5 minutes, but panels remain in molds an additional 3 to 5 minutes under pressure but not heat.

Finished door-frame pillar is removed from press, permanently glued and shaped. Ford now has 18 of these 75-ton-capacity presses. At top left are power and oscillator sections of Thermex® dielectric heating unit. Timer automatically shuts off power in hydraulic press at end of heat cycle.

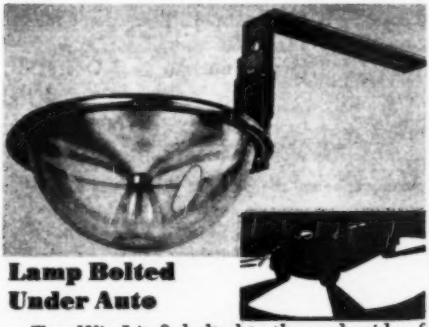
Plywood panels are bolted directly onto outside of all-steel underframe to form station-wagon body. Panels are so attached that individual sections can be removed and replaced if damaged. Phenolic-resin glue in panels makes moisture-resistant bond that's stronger than wood itself.

Transit Measures New Cars

EXACTLY how long is a new car? How high and how wide? What's the leg, head, and hip room inside? The road clearance?

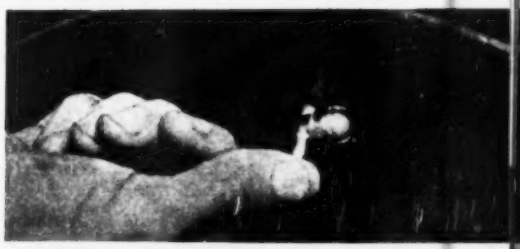
To determine these and other dimensions of Ford and competitive cars, Ford engineers use surveyor's transits, a height-gauge manometer, levels, and other instruments. Results are accurate to a fraction of an inch.

The work is done on a steel floor that can be levelled to hairline precision. Transits slide along a railing at one side and one end of the floor. Used as seen in the photo at right, these yield length and width measurements. The manometer, a liquid level device, gives most of the vertical figures.



Lamp Bolted Under Auto

THE Wix-Lite®, bolted to the underside of a car frame, throws a 40′ circle of light. Made by Wix Accessories Corp., of Gastonia, N. C., it provides illumination for passing, fog driving, entering and leaving a car, tire changing, and backing. It can be installed on tractors for night work. The lens is shock-resistant plastic. Price is about $9.



Pressure Gauge Kept on Tire

PERMANENT gauges made by K. Emsley, Ltd., Bradford, England, guard against underinflation. They work at predetermined pressures. To check, you press a plunger. Unless a bubble appears in a plastic dome, air is low. It's added with the gauge on.

Retainer By-Passes Grease

LEAKAGE of excess grease into rear brake drums is said to be eliminated by use of the Thomas By-Pass Grease Retainer® made by South Gate Brake Specialities, South Gate, Calif. This retainer by-passes excess grease to the outside instead of letting it go through the retainer. The backing plate's bottom bolt is left out and grease passes out through the hole. A felt retainer wipes the hub free of grease that's passed to the outside.

Stethoscope for Mechanics

A STETHOSCOPE-LIKE device, adopted by the Studebaker Corp., probes an engine's innards in much the same way a physician listens to your heartbeat. A metal rod leads to an amplifying diaphragm encased in a plastic housing. Sound, boosted by the diaphragm, travels up to the hearing ends in the mechanic's ears. Outside noises are shut out.

Gus Prescribes

By Martin Bunn

YOUNG Dr. Rhodes, fresh from his internship, has been in our town only a few months. The going hasn't been easy. He finally found a little office and then sweated it out for a couple more weeks while waiting for office equipment. Add to this an old sedan with a chirp that was a cross between an anemic canary and a peanut roaster, and you'll see why Doc was ready to visit a doctor himself.

The older, established physicians were feeding Doc a lot of their night calls. That's why he bought the car. He'd only had it a short time when that high-pitched chirp developed. The birdie only sang when the engine idled or when the car was moving slowly in high.

The squeak while idling was worst. That usually took place at an intersection when he was waiting for a light. Doc, hoping the noise would go away, tried to ignore it.

But the afternoon he stopped at an intersection near the high school – that did it. Mandy Manville was riding with Doc. She's about the prettiest music teacher our high school ever saw and Doc was seeing her regularly, picking her up after classes nearly every day. The squeak started as usual when he pulled up to wait for a red light.

"Listen to the birdie," jeered one of a group of students waiting for a bus.

"Somebody gave him the bird and he kept it," said another. This brought laughs from the boys and giggles from the girls.

"Maybe we could get him to bring it to our singing class," said the first student. "It might be some kind of rare canary."

With a very red face, Doc drove away from the intersection. He shot a sidelong glance at Mandy. She was looking at him.

"Doctor Rhodes," she began with mock seriousness, "that bird has got to go—if I have to shoot it myself."

"I know," he said. "Maybe it will just go away. It just came, you know."

"It sounds as if it has moved in permanently," she said. "I think it likes you a lot."

"I'll put salt on its tail," he told her.

"John," Mandy said, "I'm serious. You heard those students back there."

"I did," he replied. "They sounded like uncouth brats. Any of them in your classes?"

"Yes, and they really aren't uncouth brats. They're just at that age when they think everything is a wisecrack. They don't mean to be cruel—just to be funny."

"It didn't sound funny to me," Doc said.

"I think," he told the doctor, "that you've got the cure for this right here in your black bag."

for the Doctor

Mechanics who handed out a free diagnosis and then prescribed the wrong remedies were getting the doctor down, especially when they charged him for operations he didn't need.

"Nor to me. It's not the first time," she went on. "The other day I overheard one of them referring to you as Doctor Squeaky. That's not very good for a young doctor just getting his start."

Doc's face reddened again. "All right," he agreed. "I'll take it to a garage as soon as I drop you off. I'll pick you up this evening for the movies."

"I hope you really have it fixed," she said. "I'm not so sure I want to go to the movies in this car if that bird hasn't been shooed."

"If nothing else," Doc grinned, "I'll personally wring its neck. No bird—especially one with a voice like that—is going to come between us and the movies."

After leaving Mandy at her home, Doc pulled in the first garage he saw. A mechanic, wiping his hands on a wad of waste, walked from the rear of the shop.

"Listen to that squeak," Doc told him.

"I hear it," said the mechanic. He raised the hood and listened for half a minute. "It's the water pump. Maybe a shot of grease will fix it, but you probably need a new pump."

"Try grease," Doc suggested.

The mechanic gave it the grease but the chirping went right on.

Tries New Pump

"I guess it didn't need grease," the mechanic said sadly, staring at the engine.

"What's a new pump cost?" Doc asked.

"It'll be $8.49, including labor."

"Okay," Doc sighed, "put on a new pump." While the mechanic worked, Doc stood around and watched.

"All right; start 'er up," the mechanic said at last.

Doc started the engine and the squeak started too. Doc looked at the mechanic. The mechanic shrugged his shoulders.

"I thought you said it was the water pump," Doc accused. "Or do all the new water pumps come complete with squeaks?"

"I guess I was wrong," the mechanic admitted, "but you needed a new pump anyway. The old one was about shot. Wouldn't have lasted through the winter."

Doing a slow burn, Doc paid his bill and drove away with his chirp. Several blocks away he saw another garage. He was determined to get rid of the squeak. It had gotten to be a sort of personal thing now, as if the car were heckling him. He drove into the second garage.

"Ah, a birdie," said a mechanic as Doc let the motor idle.

"Yes," Doc said grimly, "a birdie—a squeak—a chirp—but what is it?"

"What you need, mister," said the mechanic, "is a new water pump."

"I do?" Doc raised his eyebrows.

"Yes," the man repeated, "a new pump. The bearing's shot on that one. No use trying to fix it. Cost more than a new one."

Another New Pump?

"You make up your mind in a hurry, don't you?" Doc asked.

"Well, I got ears," he answered. He raised the hood and turned to Doc in surprise.

"I had that pump put on less than an hour ago," Doc told him. "Guess again."

"If it's not the pump, it must be the fan," the man said. "Ever try lubricating it?"

"No," Doc snapped. "You try."

The mechanic oiled the fan bearing but the chirp didn't stop.

"Now what is it?" Doc asked.

"It must be the fan belt," the mechanic said. "Watch this." He squirted powdered graphite on the belt. The birdie continued. He squirted more graphite. The squeak went on and the fan belt began to slip.

"Got any more suggestions?" Doc asked.

"Yeah," said the mechanic. "You need a new fan belt."

"How much?"

"Dollar seventy-five."

"Put it on," Doc told him.

It was the same story when the new belt was installed and the engine started. Doc's birdie was still on active duty.

"Can you think of anything else?" Doc asked. "Would you like to put in a new engine?"

"Well, I'll tell you. Maybe . . ."

"No," Doc said firmly. "I'll tell you and without a maybe. I've had enough." He paid the bill, slammed the car in gear, and roared out of the garage.

A few blocks away, he saw Mandy. She was leaving a grocery store. Doc and the squeak pulled up to the curb.

"Hear you still have that rare bird," Mandy said.

"I've been to two garages," Doc replied, opening the door for her. "Get in. I'll drive you and the groceries home."

"Did you try the Model Garage?" she asked.

"No," he answered, "but the two I did try didn't have the cure. The diagnosis is free but you pay for the remedy, even if it's the wrong remedy."

"You sound like a doctor's patient," she laughed. "Try the Model Garage. Father swears by Gus Wilson."

"The way I feel now," Doc told her, "there isn't a mechanic in town I wouldn't swear at."

"Go on," Mandy urged. "Try the Model Garage. Remember, I'm still debating whether I want to go to the movies if that nasty little bird tags along." She was smiling as he left her at her home.

When Doc drove into the Model Garage shop, Stan Hicks was checking the water in the batteries on the charge rack. He looked up and grinned.

Doc Himself Has the Cure

"Don't tell me what's wrong," Stan said. "You need a new water pump."

"Look," Doc began, fast running out of temper. "I'm going to tell you. I don't need a new pump. The fan bearing doesn't need greasing. I don't need a new fan belt. But what I do need is a mechanic who has enough brains to stop that chirp instead of sticking me with a lot of new parts I don't need."

"Now wait a minute," Stan said, taken aback by the outburst. "You're that new doctor—Doctor Rhodes, aren't you?"

"That's right," Doc snapped, "but what's that got to do with this squeak?"

"When patients come to you, do you tell them what's wrong, or do they tell you?" Stan asked.

"What goes on?" Gus asked, stepping over from his bench.

Dr. Rhodes told him about the other two garages, what they did, and how much the tariff had been. Gus listened patiently until Doc had finished.

"Just selling parts isn't our business," Gus said. "We correct what's wrong or it's no sale."

"You're the first one I've heard say that," Doc grinned.

"All right," Gus said, "start the engine." He listened a moment and then added: "It's a fact that a chirp like that very often is the fan or pump. But I'm glad to know it's neither in this case. Simplifies the job of diagnosis."

Gus listened to the squeak as the engine idled. He decided the sound wasn't coming from the front of the engine—by the pump or fan—but farther back.

"It might be the fuel pump," Gus said, "but it might be here. Cut the ignition."

Gus snapped off the distributor cap and then turned to the doctor.

"I think," he told Doc, "that you've got the cure for this squeak right there in your little black bag."

"What do you mean?" Doc reached for his bag on the front seat.

"Got a tube of petroleum jelly?"

The doctor opened his bag and handed Gus the tube. Gus pulled off the distributor rotor and dabbed a thin film of the jelly on the cam. He replaced the rotor and snapped the cap back in place.

"Start the engine," Gus said.

This time, when the engine idled, there was no squeak.

"That's wonderful!" Doc grinned.

"I wouldn't say so," Gus chuckled. He cut the ignition and removed the cap again. "See that little fiber block on the breaker arm that bears against the cam? When the cam's bone dry, the block makes a chirping sound at low speeds. When the engine revs up, the cam spins too fast to let it chirp. Not a good idea to oil it. Spinning around, it might throw oil around inside the distributor and foul the points."

"It still seems wonderful to me," Doc said. "The way you located it so quickly. How much do I owe you?"

"The way I figure it," Gus grinned, "your petroleum jelly plus half a minute of my time add up to nothing at all."

Doc grinned back. "Thanks a lot. You may not know it, but I think you've just made a lifetime customer."

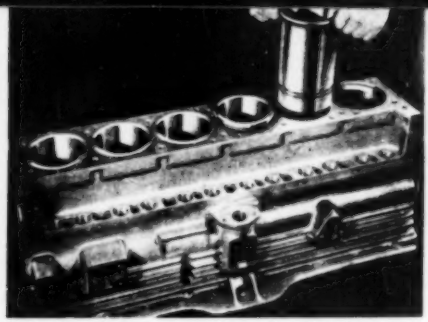
"That's the kind we're always looking for," Gus told him.

As Doc drove out of the garage, Stan turned to Gus. "I sure got off on the wrong foot with that guy," he said.

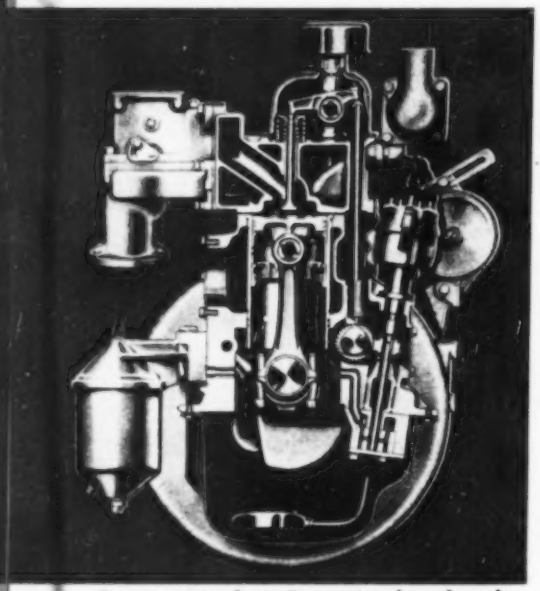
"So I noticed," Gus answered. "You know, Stan, a good garageman is like a good doctor. One of the most valuable things he offers his customers is a listening ear. Talking about their car troubles makes the folks who foot the bills feel a little better. And sometimes, listening to them saves a mechanic from pulling a boner."

"From now on," Stan said, "I'm known around here as The Ear." END

Hood swings up from the bumper line on Reo's new trucks to make engine more accessible. Engine has 6 cylinders and overhead valves.



Cylinder sleeves are easily replaced without special tools. An overlapping block gasket and rubber seals at bottom keep them watertight.



Cross section of new Reo engine shows how the sleeves fit in the block. The intake manifold is cast as a unit with the cylinder head.

Reo Adopts Removable Cylinder Sleeves

RENEWABLE cylinder sleeves of the "wet" type are used in a new heavy-duty gasoline engine engineered by Reo Motors, Inc., for its big trailer trucks. This means that cooling water comes in direct contact with the outer surface of the sleeves.

Adoption of a cylinder of this type offers truckers two advantages. When an overhaul is due, sleeve and piston assemblies can be replaced, producing what amounts to a new engine. While the engine is in operation, the cooling water can do a better job of heat removal because the sleeves are of uniform thickness. In contrast, conventional solid engine blocks have uneven surfaces on the water-jacket side of the cylinder wall.

Called the Gold Comet®, the 331-cu. in. engine develops 140 hp. at 3,200 r.p.m. The engine is "square"—that is, the bore and stroke are equal, both 4⅛".

Hoist Enables One Man to Handle 225-lb. Spare

THIS spare-wheel hoist is located under the frame of a new 2½-ton military truck that Studebaker has submitted to the Government for trial. Operated by a removable crank, the hoist permits one man to raise the 225-lb. wheel and tire into position for mounting on the carrier.

The new truck has six-wheel drive. An undergeared front axle, coupled with a free-wheeling clutch, automatically controls the six-wheel drive on soft or wet ground. All axles are double reduction, with a straight-line drive from three propeller shafts.

Perry Cooling System Filter, left, and the Mota Gard, right, remove sludge and other foreign matter from cooling systems, preventing overheating that can lead to expensive repair bills.

Filters Clean Radiator Coolant

MUCH of the trouble caused by engine overheating can be eliminated with one of these new filters in the cooling system. The Perry Cooling System Filter®, made by Spark-O-Liner Corp., Minneapolis, contains a chemically activated element that softens and cleans the water. Vulcan Mfg. Co., Inc., Winona, Minn., makes the Mota Gard® that removes sludge, grease, and scale. When Mota Gard is filled, a bypass automatically opens—signaled by a red ball in the filter—to let the water continue to circulate.

Jack Made of Cast Aluminum

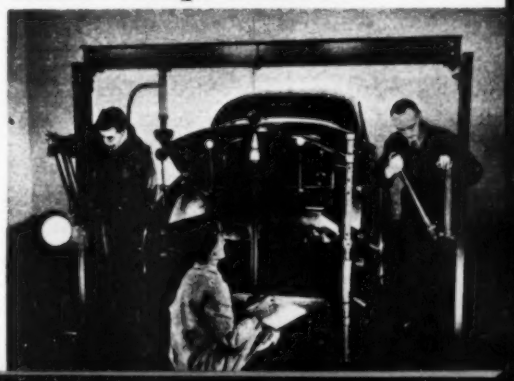
THIS transmission jack for repair shops, made by Accurate Parts Mfg. Co., Cleveland, is of cast aluminum with a threaded steel spindle. It weighs 7⅛ lb. and has a lifting capacity of 500 lb. The overall lift is 7" from a low limit of 13¾". It's mounted on rubber-tired wheels.

Bumper for Motorcycles

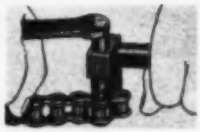
MANUFACTURED by Harley-Davidson Motor Company, of Milwaukee, Wisconsin, a chrome-plated steel front bumper for motorcycles combines utilitarian value with a decorative, streamlined appearance.

Theftproofing Tests Given Rear Compartments

ENGINEERS of the Fisher Body Division, General Motors Corp., in attempts to make the rear compartments of their new models as theftproof as is practical, are using a series of jacks and gauges in stress tests. In the photo at right, the jack on the left pushes down, the one in the center is stationary, and the one on the right pushes up. Gauges are used to measure the amount of deflection of the lid under various pressures.



Motorcycle Drive Chains Need Exact Adjustment



DRIVE chains on motorcycles shouldn't be so loose that they slap other parts, nor so tight as to have no free play. There is no better way of inviting a broken chain on the road. In adjusting a chain, first turn the wheel to find the tight spot (used chains almost always run tighter at one point on the sprocket). At this setting, adjust to leave about ½" up and down movement midway between the sprockets, as at left.

It's a good idea to inspect the chain once a week and make any required adjustment or repair. A damaged link can be replaced with the chain-repair tool seen above.

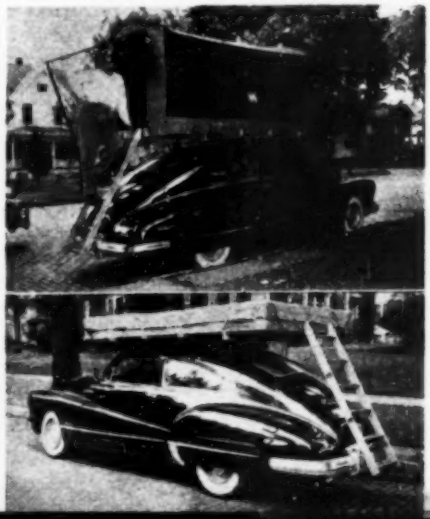
Remove the chain occasionally, soak and wash it in kerosene, and hang up to allow the kerosene to drain off. Then swish it around in a pan of light engine oil, or grease heated to that consistency, until the lubricant has worked into all inside parts. Wipe off excess oil and allow to drain.

Rewiring Job Simplified

WHEN adding lights or horn relays to the wiring system of an old car, a terminal strip on the firewall simplifies connections. The metal strip shown in the photo below is ⅛" by ½". It's tapped for connections and mounted near the steering column on two standoff insulators. The lower wire is connected to the starter terminal; the upper wire to the ammeter. In this hookup, the other wires run to the headlights and horn relay. The unused screw is for a possible additional connection. *—John M. Avery, Dexter, N. Y.*

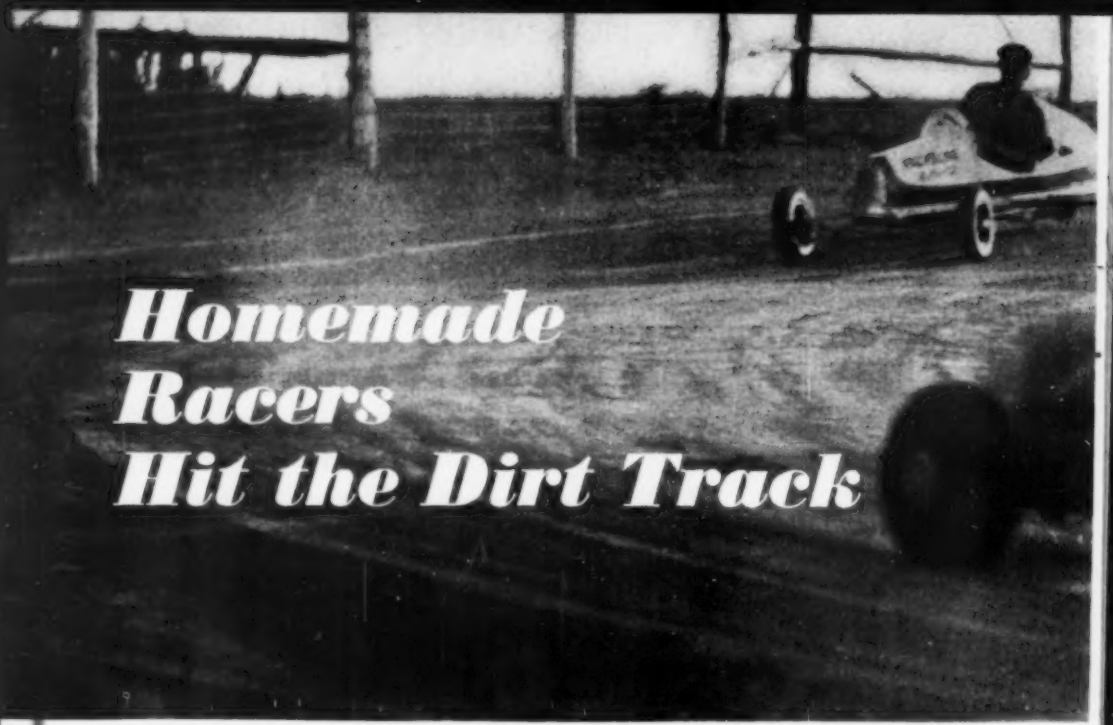
Tent Carried on Auto Top

COMFORTABLE sleeping accommodations with such refinements as air mattresses, screened windows, and electric lights are incorporated in this auto-top sleeper. The unit, designed by Robert O. Bickel and Homer Carley, Jr., of Cedar Rapids, Ia., can be opened or collapsed for traveling in a couple of minutes. The platform is 1′ deep, 5′ wide, 10′ long. There's 4′ 10″ of headroom in the tent. In driving tests, the designers hit 90 m.p.h. with the sleeper folded and 65 m.p.h. with it opened to full height.



Mechanics and Handicraft

Homemade one-lung racing cars roar on country track in a new amateur sport. See next page.



Homemade Racers Hit the Dirt Track

Coming out of a tight turn, Eubank car has a good lead over Howard's. Note latter's wheel tilt.

Indiana group builds and races tiny "micromidget" speedsters in sport started by article published in PS.

By Stewart Rouse

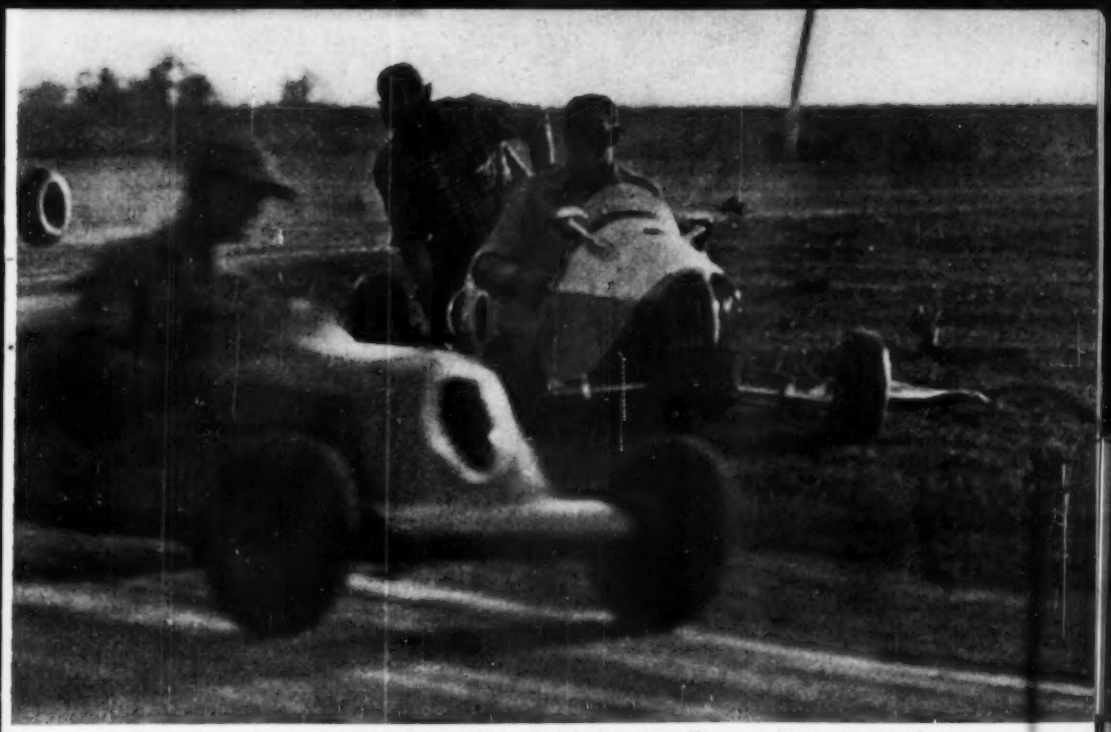
Photos by Bill Mickler

IF SOME evening you should happen to be flying over the Indiana corn belt, a bright patch of light in the darkness might catch your eye. Circling low, you see a tiny race track, packed into the feed lot between a farmhouse and its barns. A judging stand, strings of overhead lights, and lines of spectators' cars make you think of a big-city speedway. But any notion you're circling a conventional race track disappears as you see the drivers up-end their little cars like wheelbarrows and trundle them out on the track for a race. What you're seeing is the regular weekly meet of the "Rushville Micromidget Racers."

How did this farm-yard speedway get its start?

Last winter a POPULAR SCIENCE article called "Engineering Your Own Midget Car" (PS, Dec. '48, p. 176) caught the eye of Lewis Eubank, operator of the Rushville

Air view from the writer's plane, showing Davison feed lot converted to "micromidget" track.



Car on grass has spun out and been lapped. A helper is pulling on the engine-starting rope.

(Ind.) Airport. Following the article closely, he put together his car in about six weeks' spare time. Practicing on the airport turf, Eubank found that the little speedster would corner, skid, and spin like a full-size racing car. Others in the airport "hangar gang" tried it out, and in short order five or six more cars were under construction. Lawrence Davison, a farmer flyer, volunteered to build an eighth-mile track in a feed lot on his farm. Surfaced with oiled dirt, the track was built with farm machinery and measures about 150′ by 295′. Spectators watch from their cars outside the fence.

To give the group necessary unity, the Rushville Micromidget Racers Club was formed, officers elected, and car specifications established. The club now has 16 members, whose ages range from 22 to 45. They include farmers, salesmen, mechanics, and retail-store owners. The cars are required to have a tread (width) of not less than 40″ nor more than 48″. Engines are limited to a piston displacement of 18 cu. in. for L-head 4-cycle power plants; 15 cu. in. for overhead-valve 4-cycle engines; 11 cu. in. for overhead valves and twin overhead cams; and 7½ cu. in. for 2-cycle jobs.

Extreme smallness of the racers is emphasized when they're seen alongside conventional car.

Smooth engine housing on Harold Stark's car, above, was made by welding together rear left and rear right auto fenders along a centerline. Rope-starting drum extends through housing.

Hood hold-down straps on Stark car were once dog collars. The front grille is framed by an oval auto-headlight rim, and the transverse front spring came from an old farm-wagon seat.

Since I was very interested* in these subminiature racers, I persuaded Bill Mickler, official photographer for the Indianapolis Speedway, to come out and photograph the micromidgets. After Bill had snapped the accompanying pictures, he volunteered to try out one of the little cars. Starting out cautiously, he was soon broadsiding the turns in fine style. Inevitably the hangar gang thought it would be fine if I tried one out too, and before I could protest effectively, I found myself fitted into a micromidget** and picking up speed fast. Bill kept lapping me like a cannonball, throwing up dirt in my face.

At first the track seemed smooth, but as we began to roll I found it took everything I had at the wheel and throttle to keep the roaring little car under control. When I finally managed to stay up with Bill, the two cars seemed to float along, apparently stationary, while the track, fenceposts, and onlookers revolved turntable-fashion past us. It became very clear to me that handling these cars in competition is far from kids' stuff. Instead, it's a real test of driving skill, judgment, and nerve.

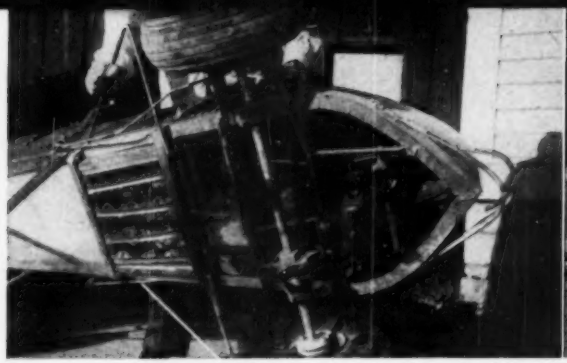
Considering the size of their engines (from 4 to 7 hp.), the performance of these 200- to 300-lb. cars is astonishingly good. Top speeds on a level, windless highway are better than 50 m.p.h. On the tiny track with its short straightaways and 180° turns they make a full lap every 16 or 18 seconds. This figures out under 30 m.p.h., but when you're pounding along inches off the dirt, it feels like three times that.

The first step in building a car is locating an engine. Burk Jaggers, president of the club, picked a Harley-Davison 125 2-cycle engine to power his racer. Larry Davison and Harold Stark, also a farmer, chose Wisconsin 4-cycle jobs, model AKN. Most of the others used Cushman motor-scooter engines. For chassis side members, most builders used the side rails of old beds, commonly 1¾" by 2" or 1½" by 1½" steel angle. The only departures from this were Jaggers' use of 1" by 2" channel steel, and welded aircraft tubing in the case of the Davison car.

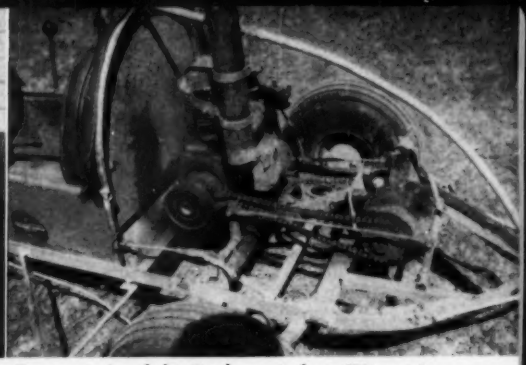
For the arches and trusswork needed to support the steering column, hood, and seat back, preferred materials are ⅜" o.d. steel tubing, ½" steel rod, or angle stock, with most joints brazed or welded. Rear axles are the straight-through type, made of 1" or 1⅛" steel shafting, and running in pillow-block bearings on the frame. Usually the left wheel is fitted with roller bearings to turn free on the shaft and the right or drive wheel is splined to the shaft. One car has an Austin rear axle, complete with differential. Wheels chosen include 4 by 8 wheelbarrow wheels, 4 by 8 and 6 by 6 motor-scooter wheels, and plane wheels from Cubs and Aeroncas.

Front-end suspensions, copied from professional midget race cars, use a steel shaft as front axle with steering knuckles at the ends. Knuckles are designed to give correct wheel camber. Steering arms are connected by tie rods adjusted for toe-in. Spring shackles on the ends of the axles connect them to two-leaf transverse springs, clamped Ford-fashion to a frame cross member. Castor or lean-back of the axle is sometimes provided by a wedge shim between spring and frame. Steel radius rods running back to the side of the chassis are commonly employed. One car is fitted with triangular

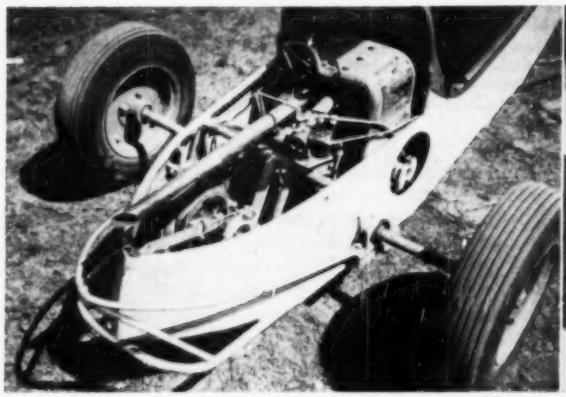
*Stewart Rouse, writer of this article, collaborated on and illustrated "Engineering Your Own Midget Car."—Ed.
**Rouse is 6'4", and probably still growing.—Ed.



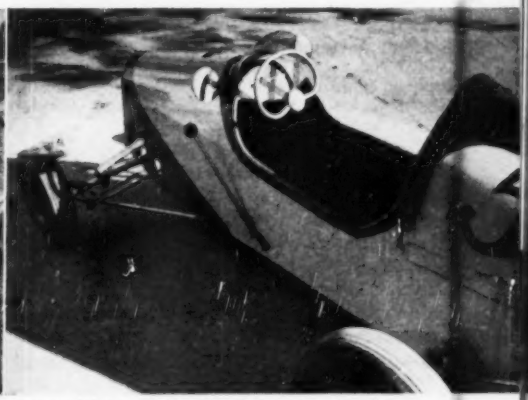
Underview of the same car shows how the frame was curved by notching, bending, and welding the flanges of steel angle stock. Note the coil seat springs and the steel wheel guards.



Power train of the Stark car is from Wisconsin engine to Mercury clutch; then via chain to an Indian motorcycle transmission; and then by a second chain to axle and 6 by 6 drive wheel.

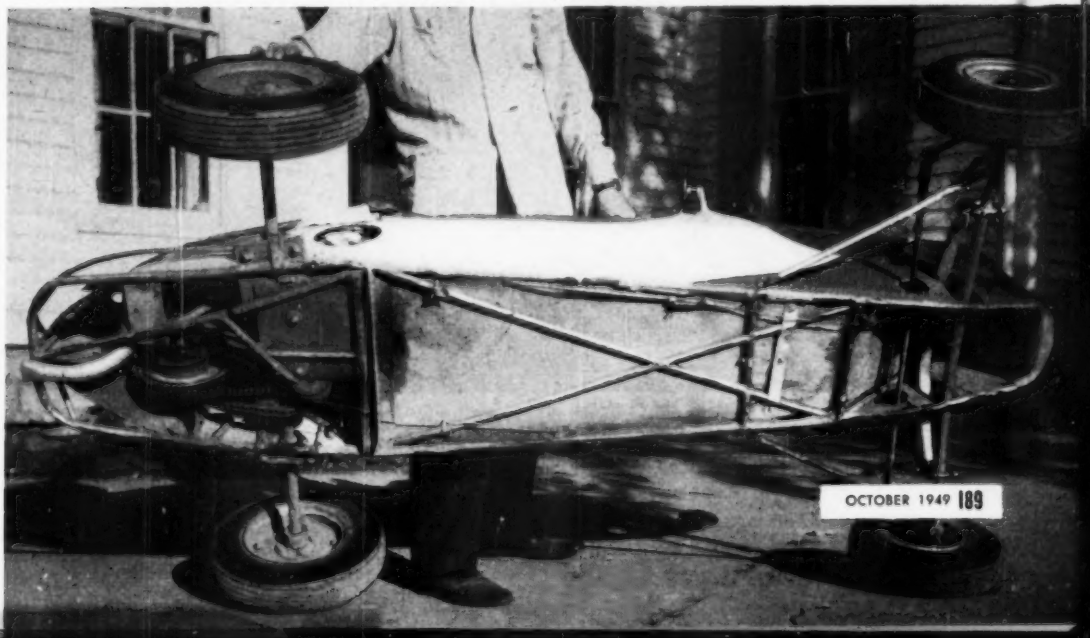


Compact and light, the engine compartment of the Davison-Dobbin car contains a Wisconsin engine and jackshaft in rear. Note the brake on jackshaft and pillow-block bearing for axle.



Steered by a plane wheel. Davison-Dobbin car has trim lines. Steering cable is held to end of tie rod by aircraft turnbuckle. Rear-view mirrors are a help in jam turns.

Davison-Dobbin car has welded tubular frame, weighs only 225 lb., and holds the lap record.



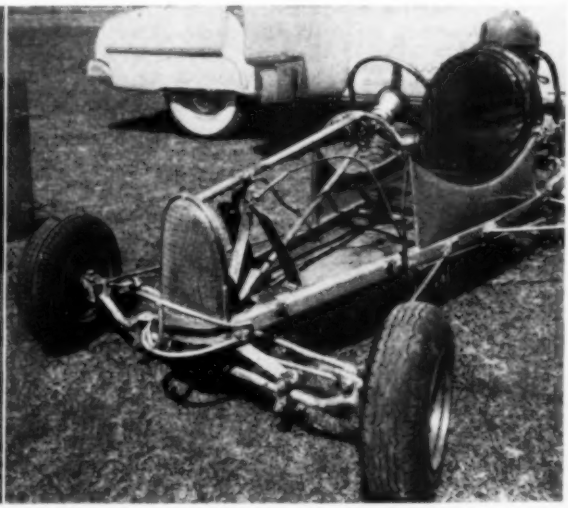
Airplane influence in Eubank car shows in use of Aeronca wheels in front, Cub wheels in back, plane control wheel, and Cub control stick as a brake lever. Latter pumps a master cylinder to apply Cub hydraulic brake on rear axle. End of the jackshaft can be seen under tail. The engine is from a Cushman motor scooter and has been fitted with oversize valves from a Pontiac.

steel guards in front of the rear wheels to prevent hooking wheels with other cars in crowded turns and mixups.

Drum-and-cable steering systems are mainly used, though Jaggers cut down a Ford Model-T gear for his car. Since the steering columns measure 1″ to 1¼″ in diameter, they serve as drums, being wrapped with about seven turns of ⅛″ steel aircraft control cable and anchored with a clip on the middle turn. The cable generally runs through turnbuckles to lugs welded on the ends of the tie rod. Steering wheels are either cut-down auto wheels or lightweight control wheels from planes.

Brakes, all hand-lever operated, include mechanical brakes taken from scooters, hydraulic brakes from planes, and in one

Driven by a motorcycle engine, the Jaggers car has a small fan to cool cylinder when engine is running but car is standing still. The big flaring tailpipe was originally a brass bedpost.



Cut-down auto steering gear guides Jaggers car. The two large pedals that straddle steering column control the clutch and throttle. The lever with knob on top applies a motor-scooter brake.

A standard Cushman engine powers the Howard car, which has ingenious ratchet system that permits both rear wheels to drive on the straightaways but lets the left one go slower on turns.

Camera catches a tense moment here: the drive wheel on No. 6 goes flat at full speed and driver fights start of a spin. Car No. 5 swings wide to pass in clear. No. 6 skidded to safe stop.

instance a homemade band brake. Clutches of the centrifugal type are used with the Cushman and Wisconsin engines; the car with a motorcycle engine has a built-in clutch and transmission. For most cars a primary chain drive to a jackshaft and a final chain drive to the axle has proved satisfactory, though several cars use a selective gearbox.

Bodies on these micromidgets are made of cut-apart and welded auto fenders and hoods. Judicious piecing of fenders makes it possible to get the compound curves involved in the tail and cowl. Leatherette upholstery, plastic windshields, and hood hold-downs made from dog collars are the finishing touches on some cars. Most of them sport a fine sprayed paint job. END

Fixing 'em on the spot is no trick when you've built them. Here Burk Jaggers is using a portable arc welder on the infield grass between races. Though practically all cars in the club have had minor or major crackups, no driver has been hurt. Wide tread, sturdy construction, comparatively low speeds, and driving skill help account for this good safety record.

Wagon-wheel spokes and a well-seasoned plank were the raw materials for this low bench. It was decided to retain the uneven edge to help give the piece the homemade look of furniture that came from the shops of early craftsmen. Natural finish shows off grain.

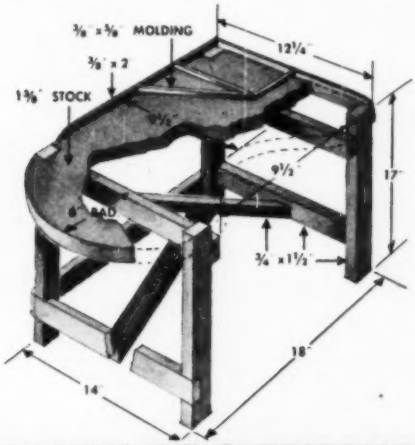
Three Antique Benches

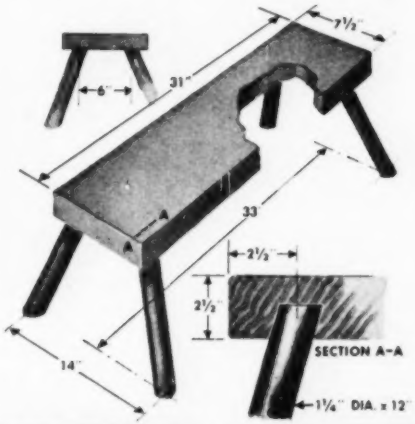
WOOD salvaged from an old building, perhaps a barn, offers ideal material for building furniture of this kind. A weathered appearance makes no difference as long as there's solid wood underneath. Planed down and given a natural finish, such wood imparts to simple furniture an air of antiquity that you'd never get otherwise. A few worm holes help this idea along.

For the bench tops, it's more convenient to have full-width stock, although you can of course glue up separate pieces. Don't let open knotholes or other openings scare you away. You can fill these with plugs cut out of scrap from the same stock.

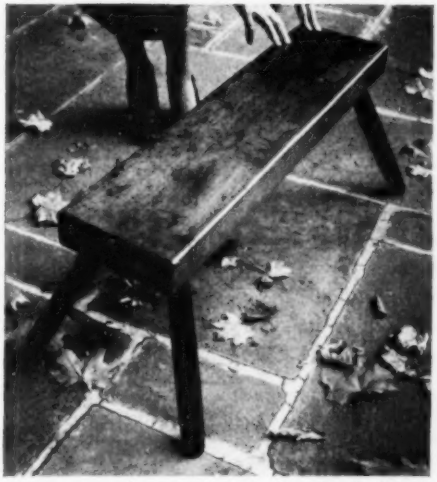
Because of their lowness, two of the benches shown are most apt to find use as stools or odds-and-ends tables beside chairs, indoors or out. The other is high enough to win a job as a coffee table.

The two low benches require no screws—just careful fitting and glue. If screws are used in the cobbler's bench, countersink them and plug with dowels. END

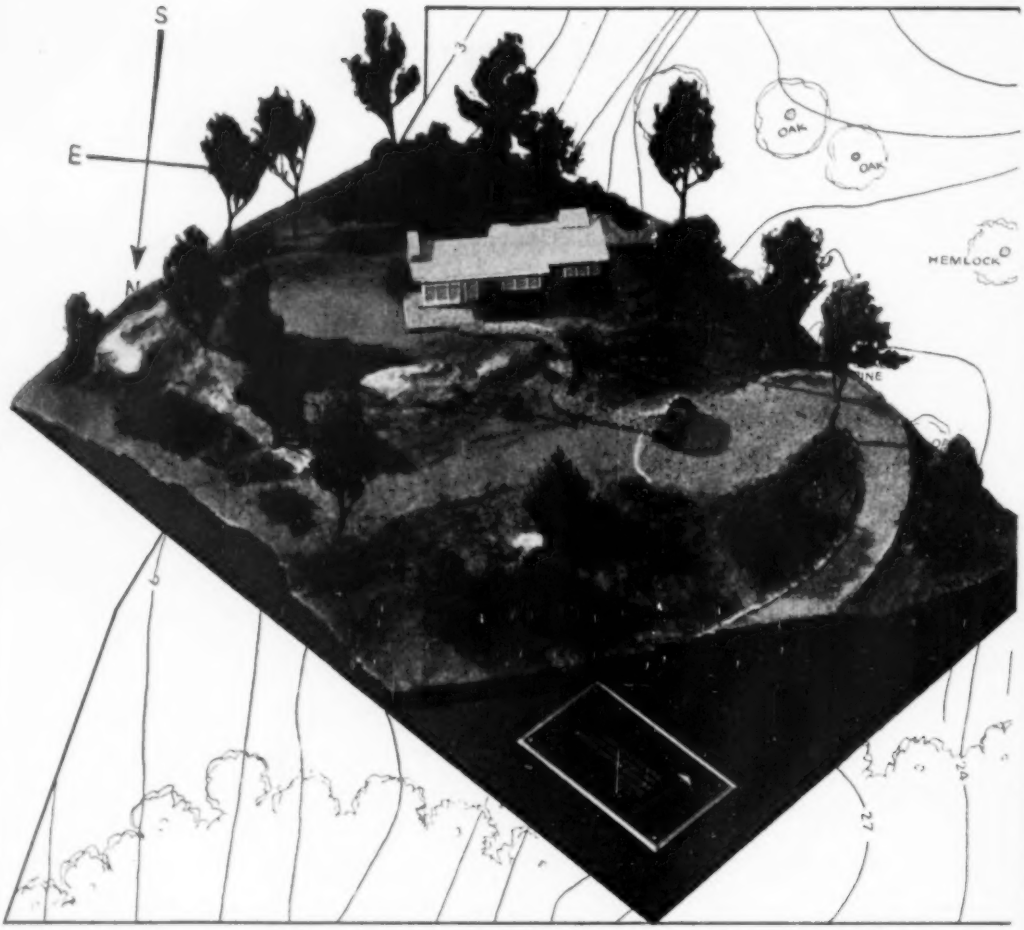




A cobbler's bench inspired this coffee table. Notice the diagonal bracing. The short piece, at the near end, butts against the longer one.



Long enough to seat two, this sturdy bench was made from a billet of used lumber. Note that previous holes in the plank were filled.



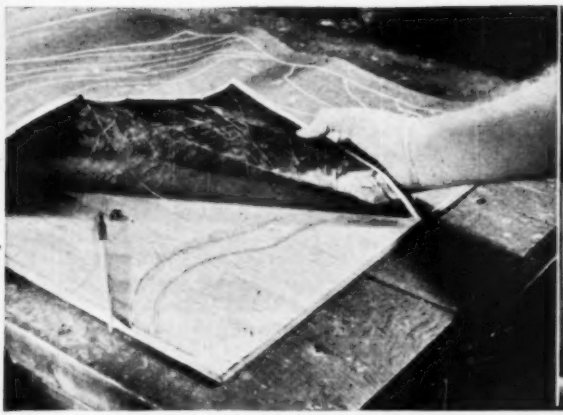
Picture your dream house in three dimensions to make best use of the land you have. A real help in planning, the model can eventually be used as an unusual decoration in the home.

How to Model Your Contour Map

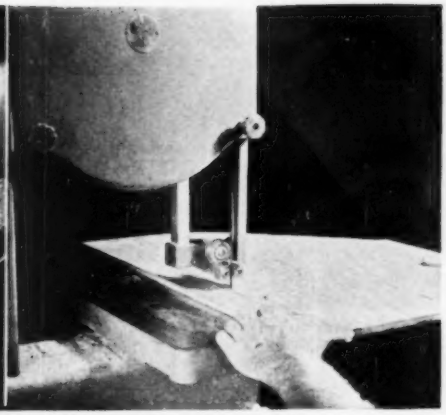
By Harry Walton

IT TAKES practice to read a contour map, but everyone can "read" a terrain model at a glance. The three-dimensional quality of a model makes it vastly superior to a sheet of paper for planning home sites, driveways, or other improvements on your property. Such a model is fun to build, too. After it has served its original purpose, it makes an unusual display piece.

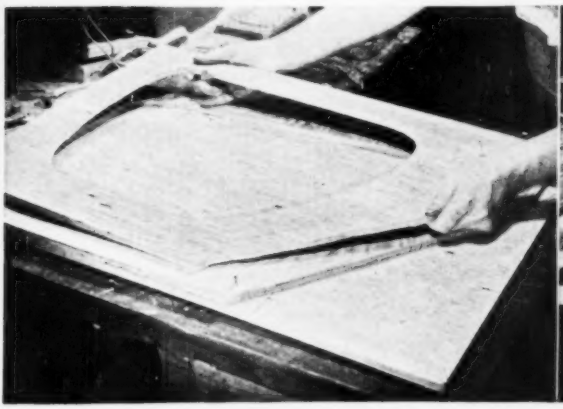
You can survey land contours yourself with a few simple tools (PS, Sept. '49, page 180). The contour map resulting becomes a blueprint for your model. If the land is mainly level, you can model it by building up a plywood panel with clay or plaster. But if the ground is hilly, freehand modeling



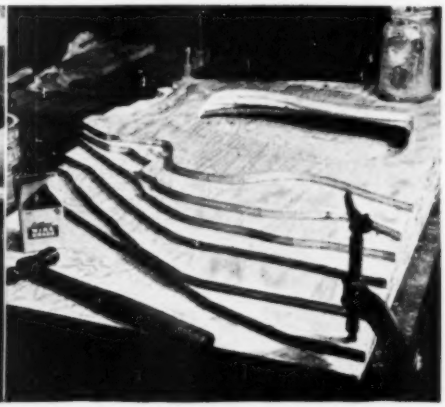
Stick carbon paper, black side out, to the back of the map with rubber cement. For each lift, draw two contour lines, the outer to cut it on, the inner to locate the next lift.



Bandsaw makes fast work of cutting out the lifts. A jigsaw would also serve. The map shown was built up of ¾″ plywood. Inside of lift is cut out to lighten total weight.



Base is a plywood panel. Here second lift is being attached; it is aligned with the second contour line on the first lift. Hole is bandsawed, the entrance kerf being filled with glue.



If base has any warp, clamp the high corners down on a true surface. Coat the joining surfaces of lifts with glue and nail the upper one down with brads. Note the hollow interior.

is wasteful and inaccurate. You should build on a core shaped to the contour lines of your map.

In drawing the map, you've probably picked a convenient scale that will be equally suitable for the model. A model of a 50′ by 100′ city lot to ¾″ scale would be 18¾″ by 37½″, a manageable size. If you're modeling a half acre, ⅛″ to the foot may be better.

Your scale, plus the contour intervals of your map, determines the thickness of the layers, or lifts, of which the model is built. If the intervals are 3′ and the scale is ⅛″ to the foot, then ¾″ fiber board or plywood will be suitable lift material.

When the lifts are assembled, they're a three-dimensional rendering of your contour map. To blend the contour lines, fill in the intervals with a modeling medium. Clay can be used but makes a heavy model. Lighter and equally permanent materials include powdered asbestos, sawdust, or wet newspaper pulp, mixed with plaster of Paris and animal glue or library paste.

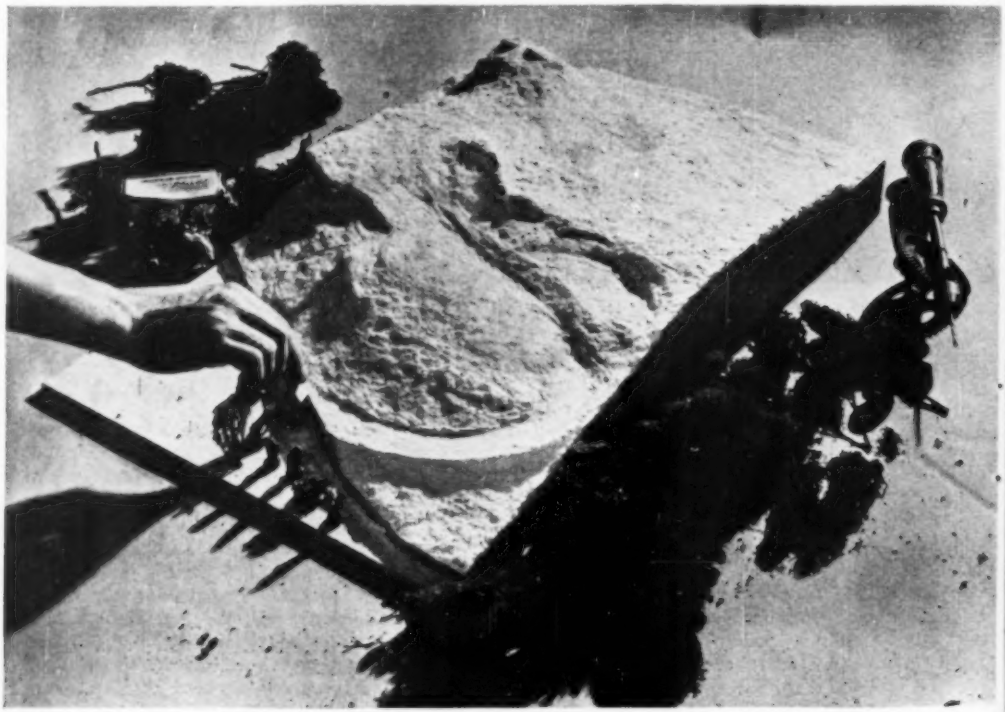
Vinegar slows setting time and so gives you a chance to model the stuff. Nothing beats fingers for applying the mix.

Add 1 teaspoon animal glue to 1½ cups water and ½ cup vinegar. Sift in 1 pt. plaster of Paris and 1¼ pt. asbestos powder. Mix should be doughlike, wet enough to adhere to wood.

Fingers are used to press the mix on wooden base. Don't pile it on top edges of lifts, which should be barely covered. Note 1′ intervals on top of model, consisting of ⅛″ lifts.

Work it in well at the edges, but don't overload the contour lines. Be sure the plaster is completely dry before any painting is done.

You can use oil paints or flat house paints, but avoid glossy paints and enamels. Poster paints are cheap, easy to use, quick drying, and have a good flat finish. But color alone produces a flat, artificial effect, whereas large-scale models like this demand textured surfaces. Apply a sealing coat of thinned paint, shellac, or varnish, and then a coat of flat paint the color of the desired surface. While this is still tacky, sift on it dyed sawdust, coffee grounds, sand, birdcage gravel,



It's not too late, even after mix hardens, to change details. Driveway was bulldozed while map was being modeled. To add it, some plaster was scraped off, some added to form the bank.

Best imitations of big rocks are little rocks. Dampen them and set into wet mix, or bed them in plain plaster. Formula given soon becomes dry and crumbly, so mix small batches often.

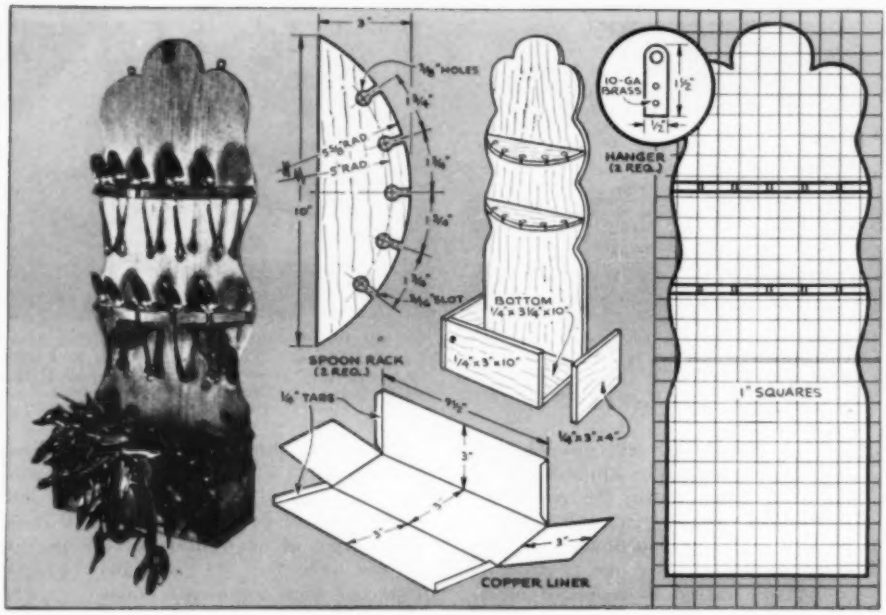
Go out on location for last-minute detail modeling. Here, last touches are put on rock outcropping that represents, on the model, the rocky ledge extending into background.

or other material that will give the scale effect wanted. When the adhesive coat has dried, blow or brush away the excess.

Rayon flock, which comes in many colors, is a versatile surfacing medium. Be careful, in applying the adhesive, not to cover rock outcroppings, except to represent moss.

Trees and shrubs can be bought from model-railroad supply houses. Sponge rubber, dyed green and torn (not cut) into shape with the fingers, makes realistic ones. Some types of trees must be built up out of wire (PS, May '44, page 161). Frayed rope cut short represents grasses. END

Trees fit into holes drilled through plaster into plywood beneath. Shrubs are Norwegian lichen moss, sold for model-railroad scenery. House is removable, built to same scale as map.



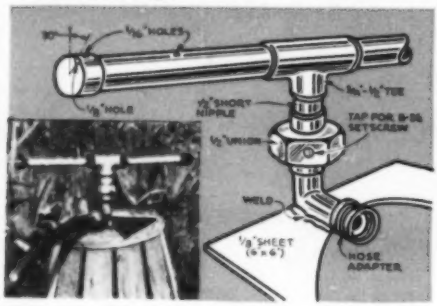
Living-Room Planter Shows Off Spoons

A TOUCH of green and a showplace for fine silver are combined in this planter. The rack shown was built of ½" knotty pine. Other wood can be used to match your furniture.

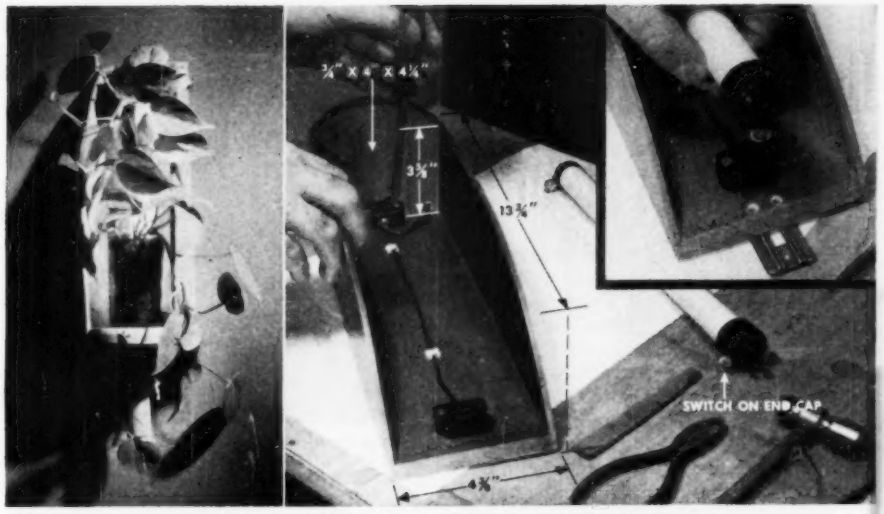
Lay out the back, using the squares, and cut it to shape with a coping saw or on a jigsaw. Cut the two spoon holders to size and drill the ⅜" holes. After the pieces are sawed and drilled, the notches are cut to the holes. Attach the spoon racks to the back with glue and No. 4 finishing nails, driven in from the back and countersunk.

Assemble the wooden box and glue and brad it to the back. The copper liner comes next. Cut it to shape and fold up the ends and sides. **To make straight,** sharp bends, clamp a piece of scrap wood inside the bottom. Use another piece of scrap to force the tabs up 90°. Clamp the tabs in position and flow solder along the joints inside the liner. *—Whitney K. Towers, Los Angeles.*

Lawn Sprinkler Built of Standard Pipe Fittings



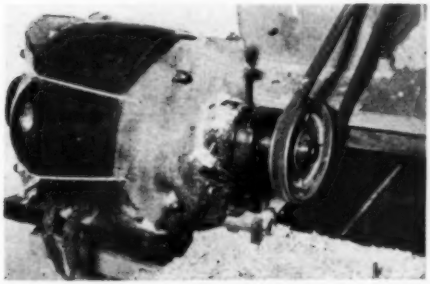
ONLY about $2 worth of parts went into the heavy-duty sprinkler pictured at left. With six outlet holes in the long bar, it covers far more territory than the average sprinkler. The caps can be turned to raise or lower the end sprays, but the ⅛" holes must be located at opposite sides at the two ends to effect rotation. To adjust, draw the union nut hand-tight and then just loosen until the bar turns freely. Lock it with the setscrew. Lubricate with cup or pump grease.*—D. C. Van Alystyne, Beverly, N. J.*



Old Scoop Makes Modern Electrified Sconce

FIND an old-fashioned wooden grocer's scoop and it's only the work of an evening to convert it to an unusual wall sconce. The one pictured here was picked up in a second-hand shop. You can make one easily enough. Use ½" stock for bottom and back, ¾" stock for the sides, and attach a big file handle to carry out the scoop idea.

The light is a 40-watt Lumiline® lamp made by General Electric. It looks like a fluorescent tube but it's an incandescent lamp. One of the fixtures has a canopy switch built into it. Screw the fixtures to the scoop and drill a 3/16" hole in one corner of the scoop for the wire. Split the cord, running one wire up the center of the scoop to the top fixture. Connect the other wire to the lower fixture.



Screen Keeps Motor Clean

SAWDUST and chips may cause overheating and fouling of shop motors. Two pieces of window screening, cut to fit the end bells of the motor, will catch much of this waste. Cut a center hole for the bearing and smaller holes for the acorn nuts. Dip the screen in light oil, drain well, and fasten it in place with string or fine wire as shown. The oil will help the screen catch dust.—*John Pugh, Ilion, N. Y.*

Sealed Headlight for Bikes

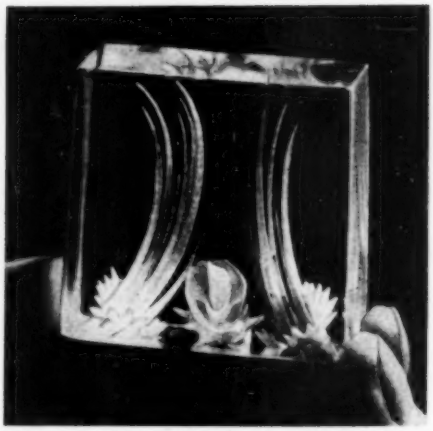
A JUNIOR edition of the one-piece, all-glass, sealed headlamp used on autos now is being manufactured by General Electric for bicycles. The lamp, mounted on the handle bars or front fender, throws a beam pattern about 30′ long and 5′ wide. It's rated to draw ½ amp. at 5 volts and has a designed life of 100 hours. Either a generator that's designed for bicycles or a battery of the 5-volt hand-lantern type operates it.

How to Drill Curves in Plastic

THE graceful curves in the plastic block pictured at right were drilled with an ordinary straight taper bit. Plastic memory—the characteristic of certain acrylics of reverting to original shape on reheating—is what changes the straight holes to curves.

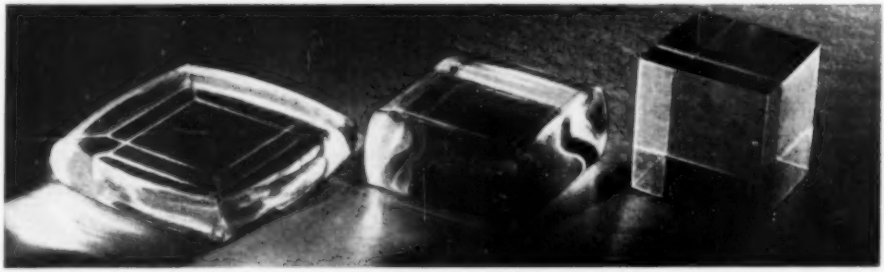
First, cut and polish a block of acrylic. Heat it in an oven and squeeze it hard in a vise, C clamp, or laminating press (PS, Dec. '48, page 204). The more you flatten it, the more pronounced will be the curves.

After it has cooled, drill the holes. It's best to drill the lines you want curved near the edges of the block. The nearer the edges they're drilled, the more they'll curve. A pleasing pattern can be formed by drilling near the four corners.

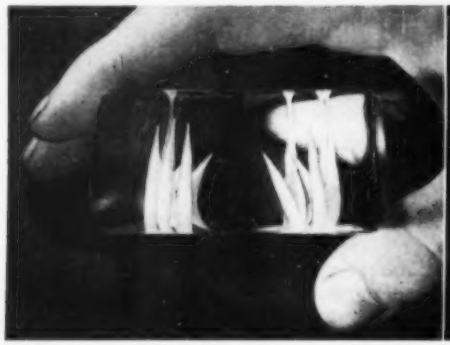


Curves combine with other internal carving to produce unusual effects. The carving may be dyed after block has resumed original form.

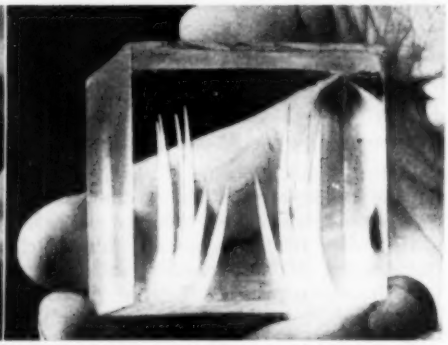
After drilling, put the block back in the oven—not in a press—and reheat until it has returned to its original shape. Do any floral or decorative carving after the block has resumed its shape. The carving then can be dyed.—*M. J. Moch, Jamaica, N. Y.*



At right is the original shape. Center shows it partially compressed. Final step is at left.



After compressing, plastic was allowed to cool. Holes, actually straight, look curved here due to optical distortion of bulged edges.



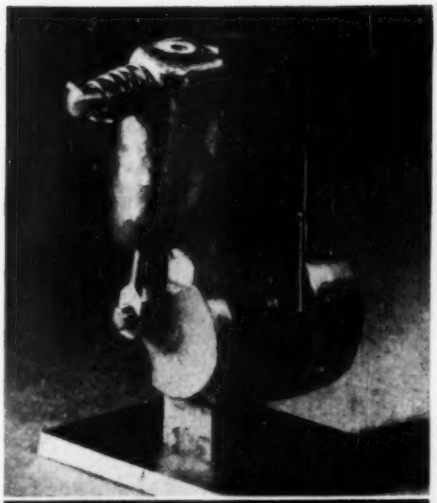
Finished block may need additional sanding and polishing to clean up surfaces that may have been scratched during work.

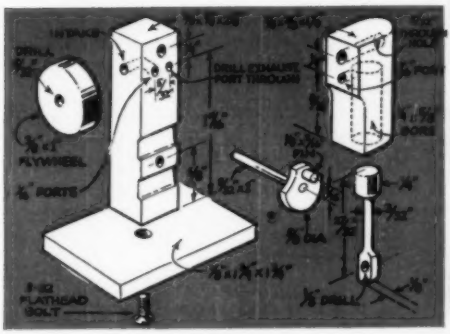
Midget Engine Has Few Parts

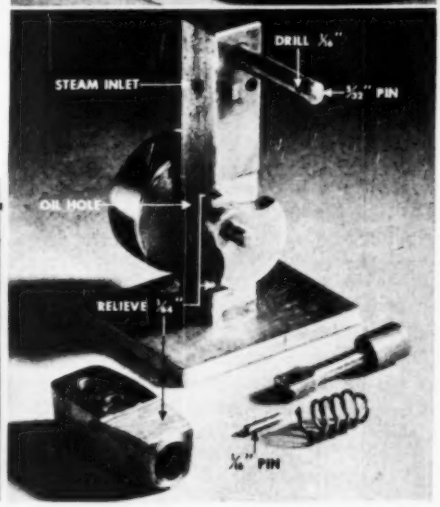
Despite its small size, this model oscillating steam engine puffs along smartly. It requires no castings. To make it, you should have a lathe and drill press, but you might get along without the former by substituting an available small wheel or a gear for the turned flywheel.

Precise placement of the valve ports is essential. When the cylinder is on dead center, its single port must fall exactly between the intake and exhaust ports in the post—without overlapping either. The valve face should be ground in to prevent leakage, and the lower part of the cylinder relieved slightly to reduce friction.

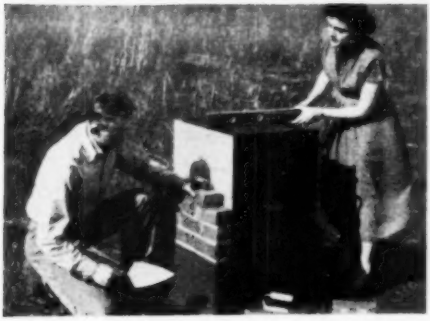
For the cylinder, first drill the bore 15/64″, then use a ¼″ drill. Square the bottom of the bore by using a ¼″ drill ground straight at the end. Use ¼″ cold-rolled steel or drill rod for the piston, turning down the connecting rod and filing the boss. Drill the boss ⅛″. If you have no lathe, it's entirely possible to saw and file down the con rod.—*Alfred Faux and A. Golding, Sault Ste. Marie, Ontario.*







Fireplace Form Helps Amateur Masons Do the Job



If you are planning to build an outdoor fireplace, here's a way you can ease the job. Price Fireplace Heater & Tank Corp., Buffalo, N. Y., offers a steel form around which you can place any kind of exterior—stone, brick, or concrete.

The unit includes a removable steak grill, an adjustable grate, and variable draft. For winter storage, you can pull the entire assembly out of the masonry. Called the Fyro-Grill®, the unit stands 22″ high and measures 17″ wide and 21½″ deep. It sells for approximately $20.

Combination bookcase is a big space saver in a small apartment. Unit includes room for a typewriter and typing paper as well as books. Above, hinged support for leaf is screwed on.

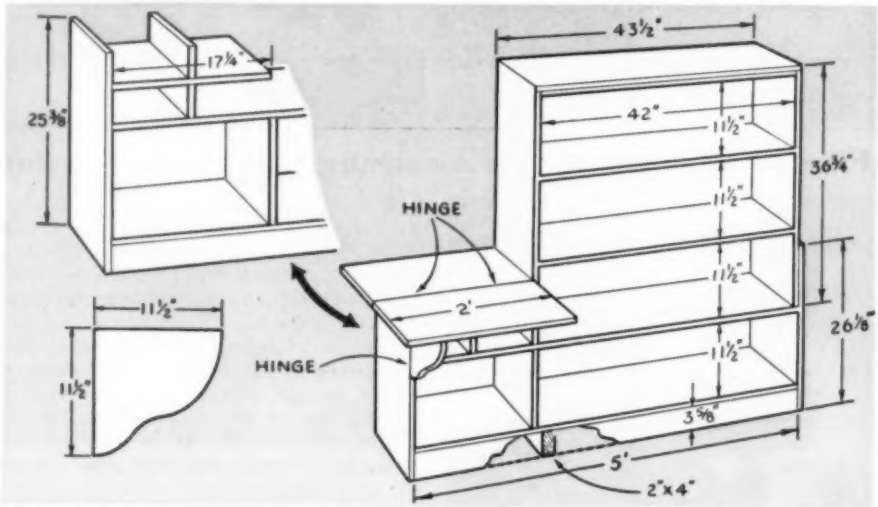
Bookcase Includes a Desk Shelf

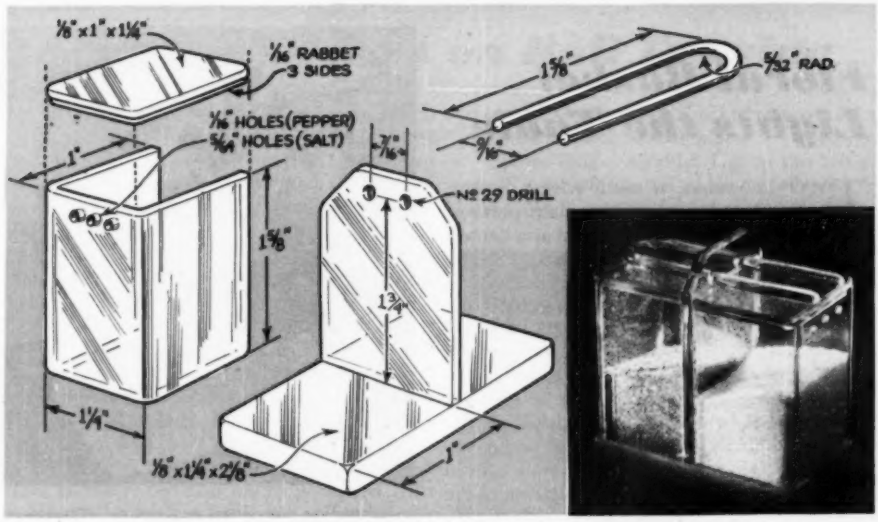
WRITING desk, typewriter stand, paper cabinet, and bookcase are all combined in this one unit. When the leaf is dropped, the cubbyholes for paper and envelopes are concealed and the top may be used as a radio table. I built this one in two sections for lightness in moving. Top, sides, and the two top shelves are one unit that fits onto the base.

Most of the lumber used was 1″ by 12″. When dressed, this stock is about ¾″ by 11½″. In building the base, you can insert as many two-by-fours as you want, depending on the weight the lowest shelf will have to bear.

The uprights at each end are glued and screwed to the base. One upright supports the desk top; the other stabilizes the upper section of the bookcase. The back boards are set inside the shelves for additional support. Two butt hinges join the leaf to the top. Another pair of butts is used to hinge the leaf support, which swings out of the way around the end when not in use.

Before the leaf and support are put on, the entire unit should be painted or varnished. *—D. W. Brentlinger, Richmond, Calif.*





Pepper Pot and Saltcellar Combined in Plastic

THIS neat little Plexiglas® package does the work of both a salt and pepper shaker. The rabbeted lids are held tightly by a removable keeper bent from ⅛" bar stock.

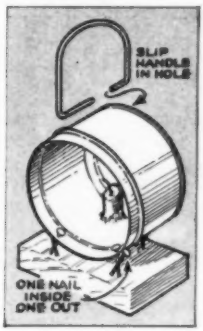
Bend the sides around a balsa form block after heating the plastic in an oven. Wearing gloves, hold it in shape around the block until it cools. Bending causes slight bulges at the edges of the bends. File or sand these until you have a true surface.

Pour a little ethylene dichloride into a saucer—just enough to cover the bottom—and soak the base of the centerpiece in it for about a minute. Spot the center on the base accurately by using the sides to locate and square it. Let the center stand until it sets. Soak the side and bottom edges of the sides in the solvent. Do this by repeatedly dipping first one surface and then the other for about a minute. Set these in place and let them dry.

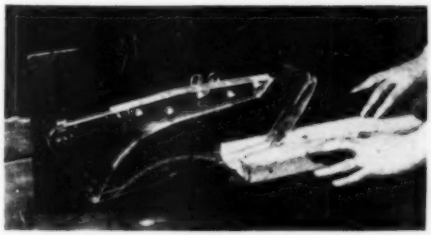
While the joints are drying, rabbet the lids. You can do this with a small router bit in a drill press, with a hand grinder locked solidly in a jig, or by careful filing. Fit the lids in place and lay out the holes for the keeper. The bottoms of these holes should be slightly below the tops of the lids. When pressed into place, the keeper will then hold the lids.—*Frank Pars, Washington, D. C.*

Lantern Made from Can

EVEN on windy nights the candle in this make-shift lantern won't blow out. As shown in the sketch at left, six nails hold a coffee can to the base. Three of the nails pass through the can. The handle is a piece of stout wire that's bent to shape. One end fits in a hole in the rear of the can and the other end is turned under to hook below the front rim.—*W. J. Spangler, San Francisco.*



Saw Guard Is Transparent



MADE of Plexiglas® by the Laminated Sheet Products Corp., Boston, this guard covers the blade but permits the operator to view the work. It's for circular saws from 8" to 20" and comes in two sizes, one for stock up to 3" and the other for thicker.

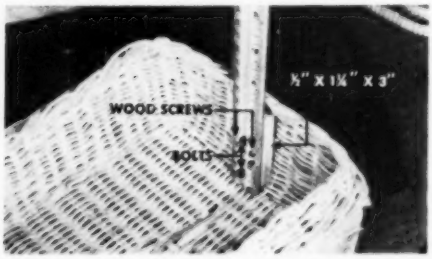
Floral Basket Lights the Table

TWO 12″ rulers, a small wicker basket, and a bread pan are the main parts of this illuminated flowerbox. Used as a centerpiece or as an addition to an occasional table, the pair of 25-watt showcase bulbs throws a subdued light. The basket pictured here cost $2. It measures 5¼″ by 7½″ by 12″. A bread pan that holds the soil just fits the bottom.

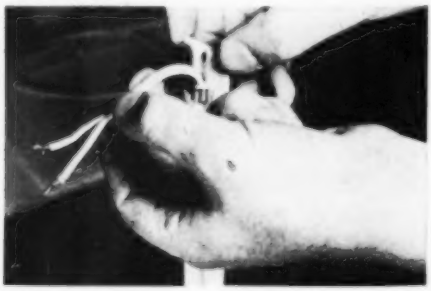
First step is to remove all excess parts—handles, hinges, and latch. The wiring runs up one of the rulers—or a wooden strip the same size—through a 9″ section of metal curtain rod. Two small strips cut from a tin can clamp the rod to the ruler. Both rulers are painted yellow to match the basket.

Machine screws hold the wooden blocks and rulers to the ends. Use washers under the heads of the screws on the outside of the basket. Otherwise, the heads may slip through the wicker when the nuts are tightened. Intermediate-size receptacles are mounted on a wooden crosspiece. Two small angle brackets and machine screws through the wicker hold the crosspiece in the top. A small feed-through switch on the cord completes the wiring. Ivy, cactus, or philodendron will look well in the basket.—*Arthur C. Miller, Manhattan, N.Y.*

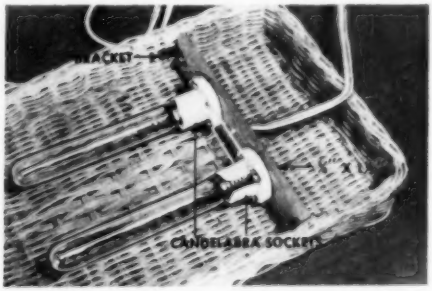
All unused parts such as hinges, clasps, and handle were removed by snipping the wicker bindings with wire cutters.



Rulers and small blocks of wood are fastened to sides of basket with machine screws. Heads of screws and washers are on outside of basket.



Lamp cord was passed through piece of metal curtain rod that was then clamped to ruler. Two 12″ rulers support top of basket.



Two 25-watt showcase bulbs provide light. Sockets are mounted on wooden crosspiece that's held by angle brackets and screws.

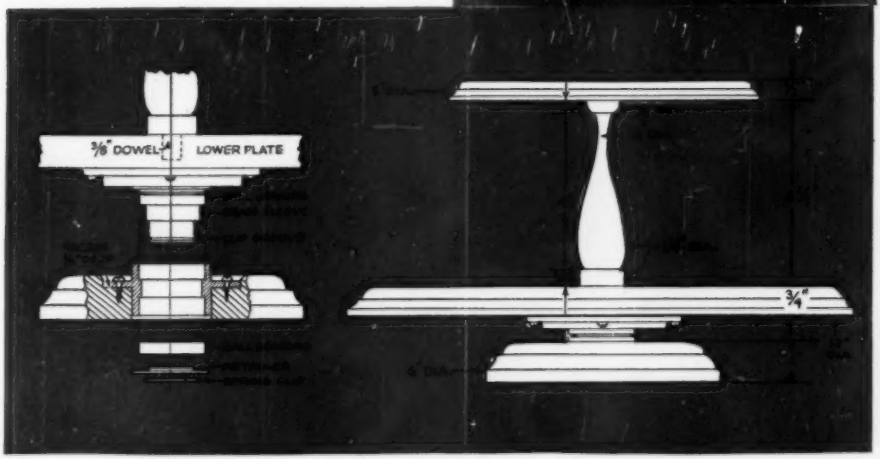
Lazy Susan Spins on Ball Bearing

NICELY balanced, this Lazy Susan whirls at the touch of your finger. Set into its base is a high-grade ball bearing I picked up in a war-surplus store for 75 cents. Supposedly, it came from a dismantled range finder. However, you can use any kind of bearing you happen to have on hand. If there's nothing better around, a roller skate wheel will serve adequately.

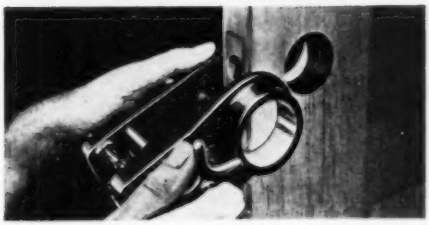
Wood of three different thicknesses was used for the table—1″ for the base, ¾″ for the lower plate, and ½″ for the upper. Chances are you'll have to glue up stock for the 13″ lower plate. Rounded and smoothed on a lathe, this has a decorative edge turned on it, as does the 8″ upper plate. The post that connects the two plates is turned with a short ⅜″ dowel on each end.

The bearing was taken apart for mounting. After boring a hole through the wood base, I dished out a depression in the top face and seated the bearing casing with screws. The bearing shaft was screwed to the bottom of the lower plate.

Before final assembly, I gave the table a triple coat of diluted shellac, followed by wax.—*Norbert Engels, South Bend, Ind.*



Drill Jig Reduces Door-Lock Installation Time



CLAMPED to a door, this drill jig is said to assure a perfect lock fit and to speed up installation. A product of Kwikset Locks, Inc., of Anaheim, Calif., it's designed especially for door locks made by this company. A spacing screw permits accurate adjustment on doors ranging from 1¼″ to 2″ thick. Made chiefly of aluminum, the jig weighs 2½ lb. It's priced at about $4.

Offbeat Jobs for Metal Molding

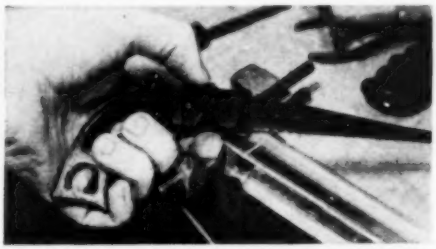
Kitchen utensil rack is a section of stair nosing. Hacksaw the slots in curved edge to take utensils, and then nail or screw to wall.

THE metal moldings and strippings sold in most hardware stores have scores of additional uses around the home. Besides those shown here, your own needs undoubtedly will suggest others.

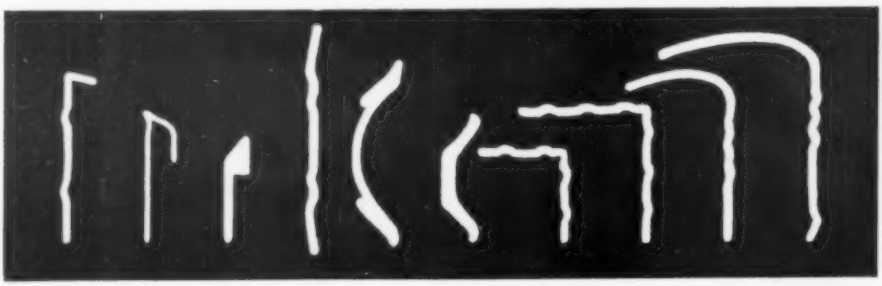
Aside from the zinc linoleum binding that's been around for years, moldings now generally available are aluminum alloy or stainless steel. The former is a bit less expensive and is easier to work; the latter is stronger and can be soldered or brazed. A hacksaw, hand drill, and files are all the tools you need.

Make 90° bends in L-shaped molding by first filing a V-notch in the flange. Curves can be bent freehand but it's usually best to bend them around a solid object of about the right radius. In designing complex projects, give some advance thought to assembly and what holes need to be drilled. Otherwise, you might find yourself in a situation where a bend prevents drilling. The moldings in sectional views below are aluminum alloy, made by R. D. Werner Co., Inc., New York City.—*A. C. Miller, Manhattan, N. Y.*

Bracket for wall lamp is bent of 1¼" flat decorative strip. Socket is attached through a ⅜" hole at the top of the straight section.



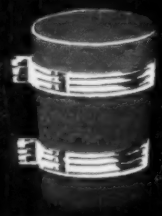
Molding is cut with hacksaw. File also may be used. For greatest accuracy in making cuts, a simple miter box to guide saw is desirable.



Tie rack is made by bending flat molding and screwing or nailing it to a door.

Stair nosing reversed is a shoe rack. Piece of cove section helps support shoes.

Telescoping book ends are made with stair nosing sliding in slots in plywood ends.



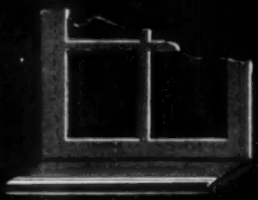
Pep up drinking glasses with two flat strips bolted to plywood handles.

Use angle piece as straightedge on a drawing board. Countersink the screwheads.

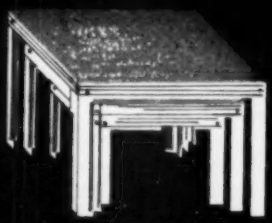
Chest has drawer slides of angles while strips of nosing are used as drawer pulls.

Two lengths of angle, bolted together and fitted in wooden fixtures, make towel rack.

Cove sections serve as guide rails for sliding doors of wood or glass on shelves.

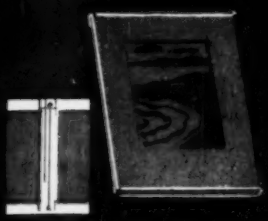


Dress up window sills by covering with linoleum and edging with stair nosing.



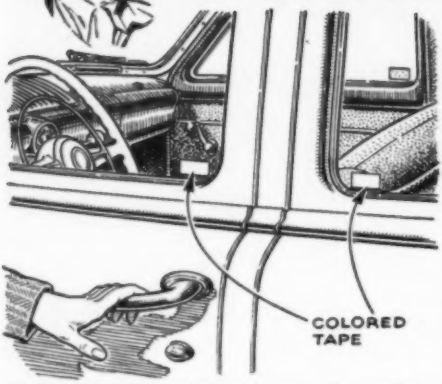
Nest of small tables has angles for legs. Nail edging around the tops.

Bracket for wall lamp is bent from length of flat molding and screwed to wall.



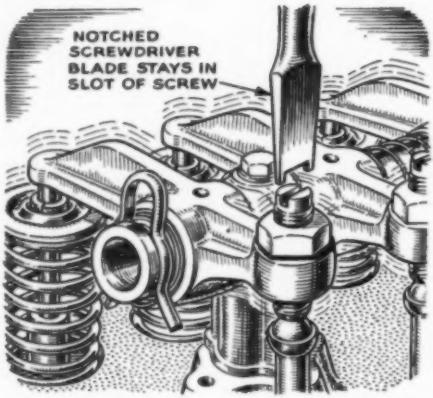
Top and bottom of picture frame is cap molding. Flat strip joins them in back.

Hints from the Model Garage

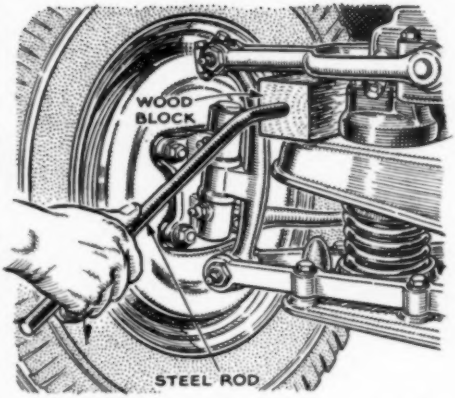


Tape Shows Windows Are Up. If you keep your car windows clean, it may be difficult to tell that they are up when you're locking the car. Small spots of colored tape applied to the inside near the bottom will show you at a glance.

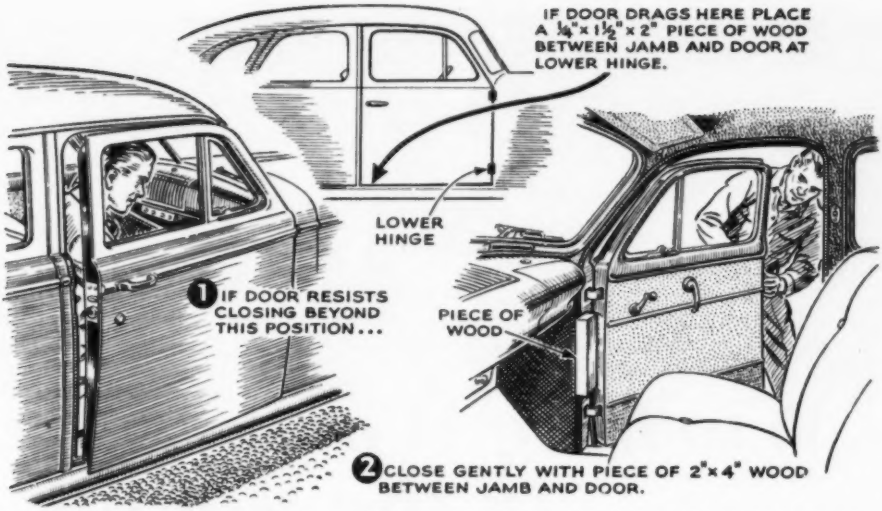
Defroster Clears Mirror. In sleety weather, Ronald Weller, of Jerseyville, Ill., found that the rear-view mirror on his truck frequently became coated with ice. To keep the mirror clear, he ran a rubber hose from the defroster out to the mirror.



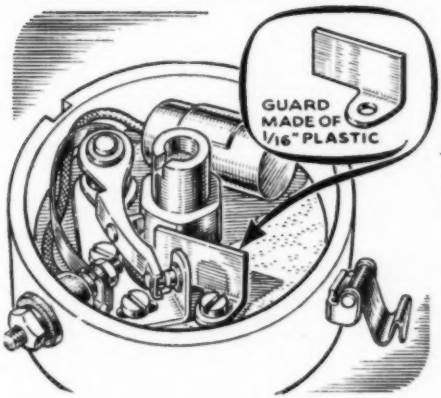
Tappet Adjustment Is Easier. It is usually recommended that the tappets of an overhead-valve engine be adjusted while the engine is warm and idling. However, you've probably found that it's hard to keep the screwdriver in position on the bouncing adjusting screw. To simplify the task, W. M. Dierks, of Chicago, filed a wide notch in a screwdriver blade. This keeps the blade in the slot while adjustments are made.



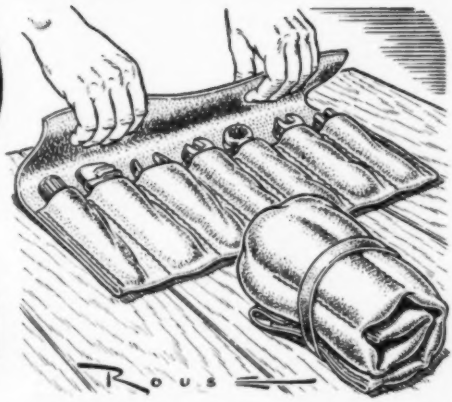
Block Stops Wheel Sag. If you've ever used a bumper jack, you've probably noticed that the front of a car must be raised quite high before the tire is free. This is because the suspension arms allow the wheel to sag. You can overcome this by thrusting a block of wood between the frame and upper wishbone. A block cut from 3″ by 3″ stock will do the job. To position the block, fit a steel-rod handle into it.



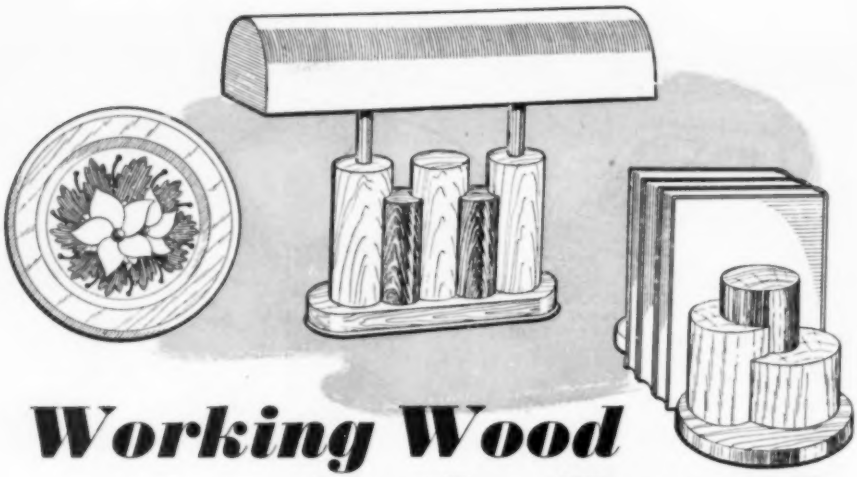
Repairing Sprung Doors. Unless they are too badly damaged, doors with sprung hinges can sometimes be put back into working condition by deliberately jamming them against a piece of wood. Burk Jaggers, Rushville, Ind., writes that he has used the method above. In closing the door, always proceed gently and keep testing—or you may have the problem of correcting an overcorrection. Should the door rub at the upper rear corner, place your block of wood between jamb and door at the top hinge.



Guard Prolongs Point Life. Ira S. Nelson, of Chicago, reports that he has experienced considerable difficulty with burned and pitted breaker points on his '49 Ford V-8 because oil worked up the distributor shaft. As a solution, he installed a small plastic shield between the cam and breaker arm, mounting it with a 6-32 screw as seen above. The shield helps keep oil from being thrown on the points.



Rubber Kit Stops Rattles. This tool kit, made from an old inner tube by Robert R. Leist, of New Albany, Ind., keeps small tools from rattling around while carried in the car. Cut a piece from the tube large enough to suit the tools you want to have at hand. Pockets to suit them can be sewn with strong cord. Cut a rubber band from the same tube to put around the kit after it has been rolled up.



Working Wood in the Round

By Edwin M. Love

ALTHOUGH a lathe ranks as one of the most useful pieces of equipment in any shop, it isn't the only means of shaping wood in the round. You can often fall back on other machines—or even hand tools. Results may not always equal turned work, but nine times out of ten no one will know the difference.

Obviously, you could use a lathe to advantage for projects like those at the top of the page. But they can be completed without turning—a fact that it's well to remember if you have been in the habit of shying away from good craft projects simply because the plans call for a turned member.

And even though you own a lathe, it will pay you to know the alternate procedures. Suppose, for instance, you need a 1½" pole longer than the maximum length your lathe will accept. You can, of course, turn it in sections and join them with dowels and glue. But if you'd rather have the pole in one piece, get a two-by-four and cut it to length, squaring the ends. One edge probably is already square, smooth, and comparatively straight. Using this as a base for gauging, rip a square-sectioned strip that measures slightly more than the desired diameter of the pole.

You can now round the strip either by hand or machine. For hand work you need only a drawknife and a jack plane.

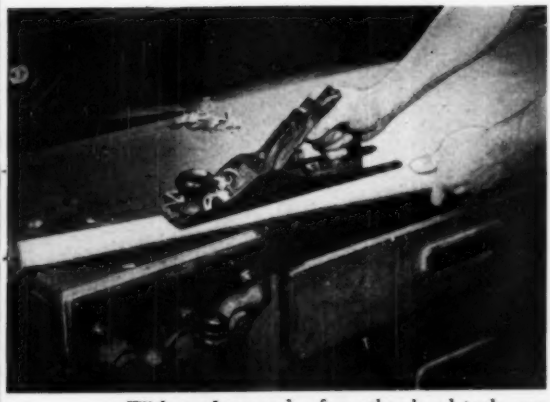
Once the stock has been squared, get out a compass and draw an octagon on one end. See Fig. 1 on page 213. Then gauge chamfers along the edges with a pencil.

Holding the work in a vise, pare off the corners with the drawknife—or any other tool that will get the wood down quickly. Finally, plane the new sides straight. For true roundness be sure that all eight sides are equal in width.

Now grasp the piece with the left hand, butt it against the bench stop, and make three passes on each arris (the sharp corner) with the jack plane, being careful to hold to the same angle for all cuts. Turn the stock end for end to finish the length. If the faces are not equal in width, take off another shaving or two from the narrow ones. Then plane off the new arrises and trim the remaining corners.

Again clamp the pole in a vise. Loop a half sheet of coarse sandpaper around it, grasp the ends with the hands, and pull the paper up and down. Shift position constantly to round the work uniformly. Turn the work and repeat on the other side. This will reduce the corners in a hurry. Finally, sand the piece lengthwise to take off the cross scratches.

Dowels for glue joints are generally purchased ready-made, but if the size wanted is not in stock they can be made in the shop by planing as already described. Or you can save yourself work by driving octagon-



With a plane and a few other hand tools, you can often do jobs that will pass for turned work. Principle here is to cut and plane off successive arrises. Then finally sand smooth.

V jig cuts square stock to octagonal section with one pass of jointer at each corner. The two parts of jig are notched and arch over the jointer head. The jig guides and supports the work.

shaped sticks through a hole in a steel plate.

Almost any old iron will do, but the plate will cut better and last longer if made of tool steel. Harden the plate after drilling it by heating to cherry red and plunging in water. Temper by heating until a light brown or straw color shows on a brightened spot, and requench the piece. For small dowels, you can hold the plate in a vise. Heavy driving, however, should be done on the bench top over a bench-pin hole.

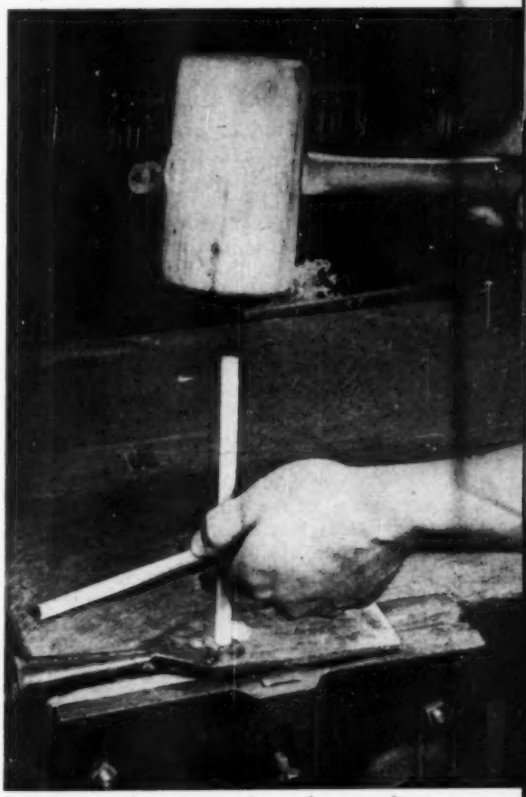
Shaper and Jointer Round Work

Shop machines that lend themselves well to round work include the jointer and shaper. A jointer rig for reducing a square strip to octagon form is seen in the photo at the top right on this page. It consists of two pieces made by miter-ripping (45°) a two-by-four or two-by-six and notching them to bridge the jointer head.

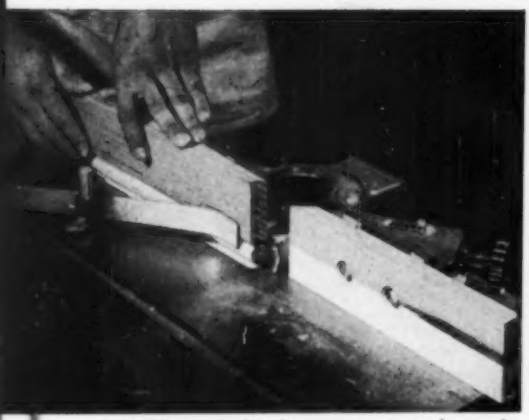
One piece is placed against the fence, the second against the first to form a complete V in which the square stick is supported without rocking. Lower both tables enough to finish a corner in one pass.

Still using the jointer, you can round short, thick work further by pivoting it on nails between two blocks. Fig. 2 on page 213 shows the setup.

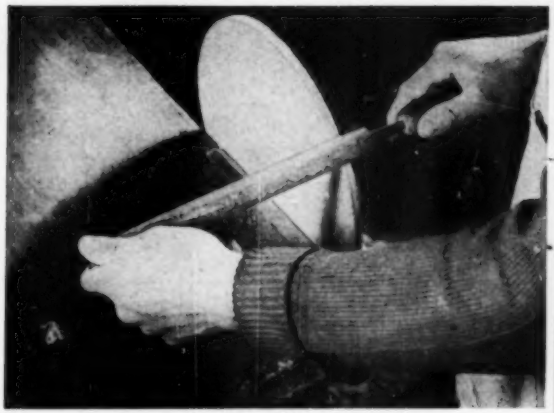
Lower the infeed table below the outfeed table equal to the desired depth of cut. Mount the work on the pivots so it is parallel to both tables, although higher above the infeed than the other. This is important. If the axis of the work inclines to one end,



Dowels are shaped in a hurry by pounding octagonal-section stock through hole in a steel plate. Sharp edge of the hole acts like a plane, stripping off the wood corners.



A half-round bead cutter mounted on the shaper cuts a dowel in two passes—one on one side of the work, one opposite. Align fence sections; use stock as thick as desired diameter.



Diagonal strokes of cabinet file smooth edge of disk before final sanding. You can do the work faster on a lathe or sander, but filing will serve in lack of such equipment.

you'll wind up with a cone-shaped or tapered piece—a good point to remember in case you should ever want to taper a piece in the round. In making the cuts, take repeated passes, turning the work a little each time until well rounded. Remove from the jig for hand sanding.

The shaper setup shown in the photo above cuts a dowel in two passes. Mount a half-round bead cutter on the spindle and align the fences. The stock should be just as thick as the diameter of the dowel you want, and the lower edge accurately jointed.

Half the dowel is cut in the first pass. Reverse the piece to put the other face against the fence for the second pass. If the depth of cut has been nicely gauged, the web above and below will be severed and the dowel will fall free with little, if any, offset or ridge appearing. Since all support is lost at the end of the cut, the dowel should be made extra long. Because this setup takes a little time, you'll probably prefer to cut a number of dowels and put them by for future use.

A shaper offers one of the best methods of producing round molded items such as porch-column bases and picture frames. As in all freehand shaping, you need a substantial guide for the depth collar to bear against. In many cases the work itself furnishes the guide. But when the entire edge is to be cut away, make a separate guide and tack it to the work. Fig. 3 on the opposite page illustrates a safe means of shaping the inside of a ring. Scrollsaw the inside only, leaving the outer corners for finger holds. When the inside is finished, saw and mold the outside.

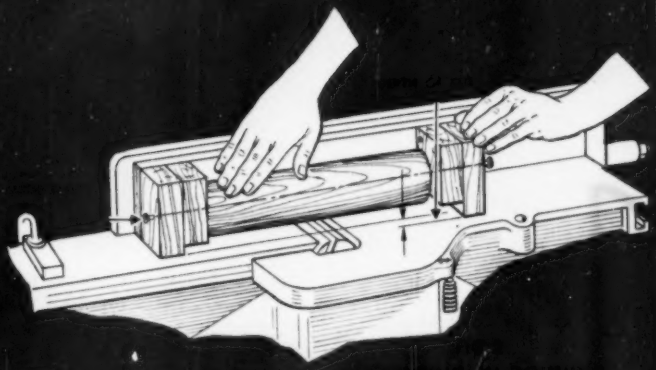
By working carefully, you can make perfectly acceptable disks by first cutting them out with a compass or keyhole saw, a coping saw, or a bandsaw. Smoothing by hand can be tedious, but the method shown in the photo above will get it done quickly. To take off the worst roughness, stroke forward and sidewise with a cabinet file. Finish smoothing by rocking a sandpaper block around the circumference. If the block is shaped to fit the curve, so much the better.

If you'd like to try your hand at actual turning, you can improvise a lathe quite easily, as suggested in Fig. 4 on the facing page. Screw two blocks to a length of two-by-four and pivot the work on nail centers passed through the blocks. Stiffen the assembly with a tool rest nailed or clamped on.

If necessary, you can borrow a motor from your washing machine to drive the assembly. Cut a groove near one end of the work for the belt or whittle down the end and force a pulley over it. The assembly must be spiked or clamped firmly to the bench or other solid support.

Another makeshift assembly (Fig. 5) will enable you to turn a wheel concentric. The illustration shows how you might proceed if you wanted to undertake such a turning project as a spinning wheel. After being cut with a saw, the wheel—and its double belt groove and ornamental side bead—will round to shape if turned by hand. END

LAYING OUT AN OCTAGON



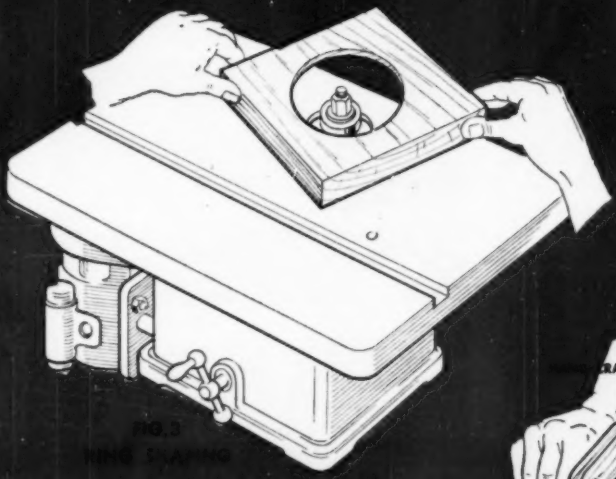
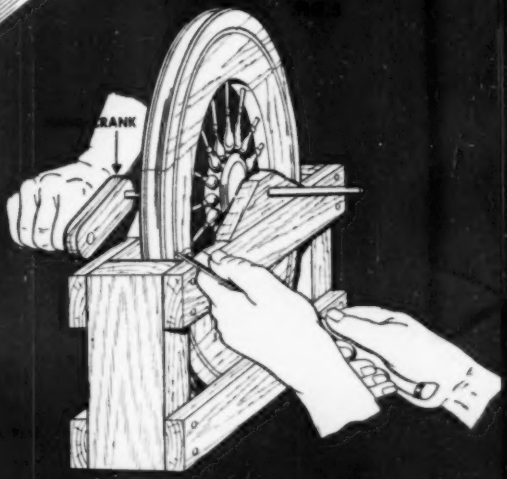


FIG.3
RING SHAPING



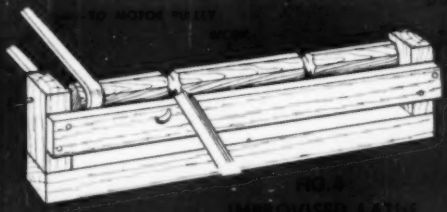
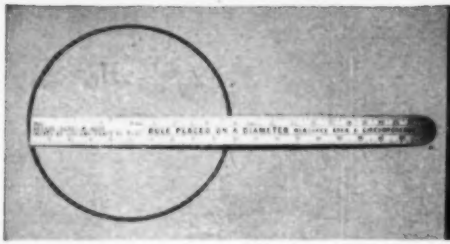


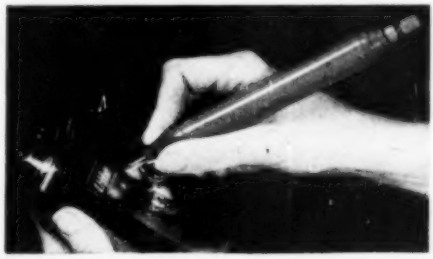
FIG.5
IMPROVISED LATHE

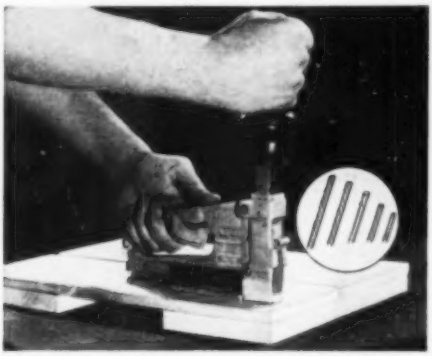
NEW TOOLS



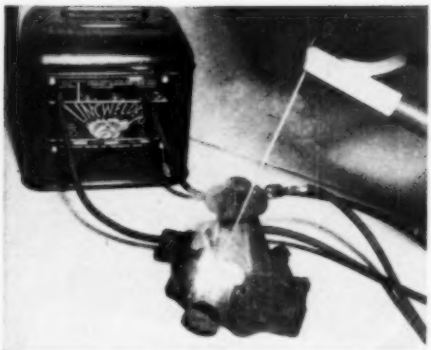
Pocket Rule Does Many Jobs. Besides measuring straight lines, this new pocket rule gives direct readings when you need the circumference or area of a circle. For this, it's placed on the diameter of the circle as pictured at the left above. A sliding clip secures the ruler in your pocket and also serves as a stop when the tool is used as a depth gauge. It's made by Technical Development, Port Washington, N. Y.

Tool Etches Glass. Shaped like a large fountain pen, the Murray Electro-Stylus®, at right, can be used to cut stencil designs or carve, engrave, and etch other materials. Electrically operated, it delivers 7,200 cutting strokes a minute. It's made by Murray Industries, Colorado Springs, Colo., and sells for about $10 with four points. A diamond-tipped point for etching glass is available for an additional $6.





Hammer with Your Fist. The new hand-operated Heller Nailer® above works like a paper stapler and is said to enable you to make assemblies four times as fast as with an ordinary hammer and nails. It drives through wood, composition board, and light metal. Heavy-duty staples feed automatically, the device holding 100 or more. Heller Co., Cleveland, makes it.



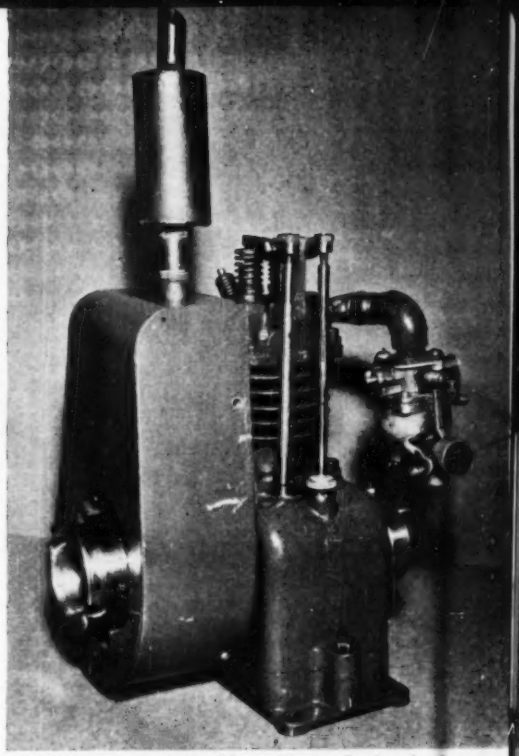
Arc Welder for Home Shop. A small transformer-type arc welder introduced by Lincoln Electric Co., Cleveland, operates from any 115-volt line fused for 30 amp. It delivers up to 60 amp. and handles 5/64" electrodes. Weighing 50 lb., it can be carried to any spot where you want to weld, solder, or braze. It sells for about $45 complete with necessary equipment.

Machining a 2-Hp. Engine From Castings

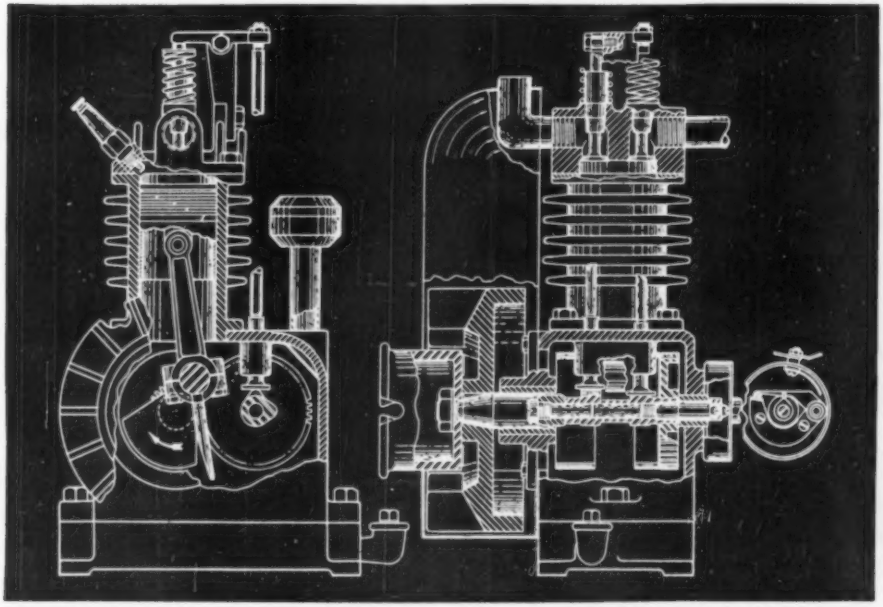
With workshop lathe and drill press, you can transform eight castings into a handy little 4-cycle power plant.

NO TOY, this husky little gasoline engine is a natural for running a lawnmower or powering an air compressor or pump. A 4-cycle engine with overhead valves, it starts easily, delivers about 2 hp. at 3,500 r.p.m., and can be run up to 5,000 r.p.m. for brief periods. It has a 2" bore and 1⅞" stroke, and is only 14" high, excluding the muffler.

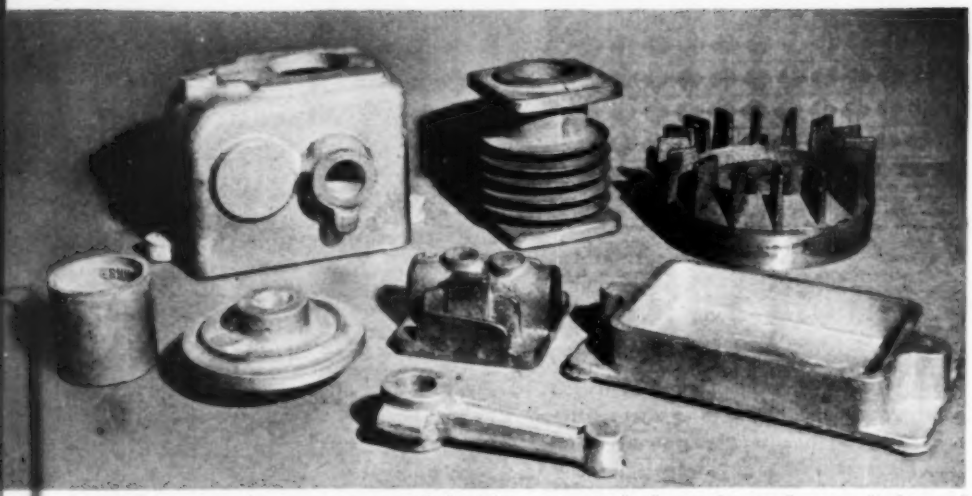
What's exceptional about it is that you can build it yourself for around $20, using



Finished engine looks like a factory-built job. Not shown are gravity-feed gas tank, spark coil from car, and 6-volt ignition battery.



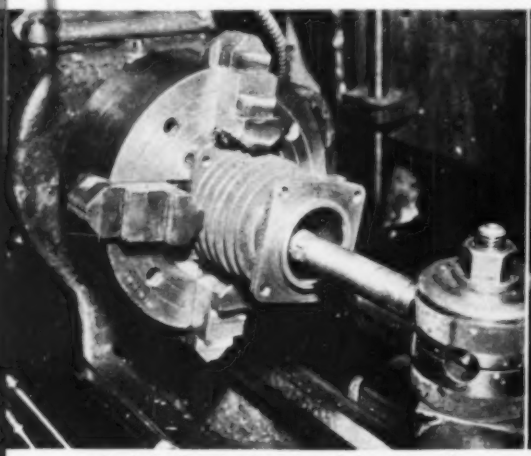
Elevation views show clean simplicity of engine. Crankcase lubrication is by splash system.



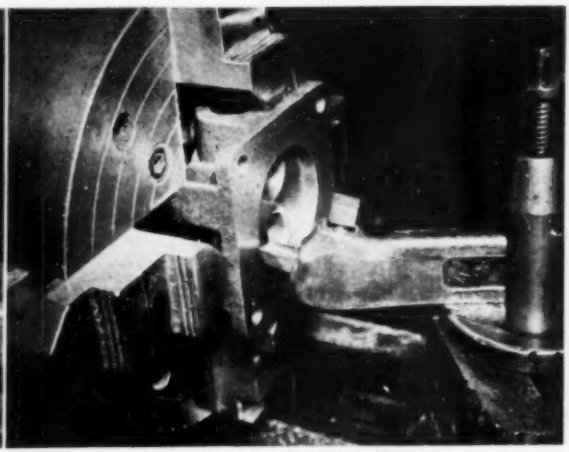
1 These are the castings provided. The three darker ones are cast iron; the others are aluminum. In center row, left to right, are the piston, end plate, cylinder head, and oil pan. In back are the crankcase, cylinder, and flywheel. Con rod is in front. First cuts on the iron castings should be fairly heavy to get under the foundry scale as fast as possible.

only a 9″ lathe and drill press. The engine was originally designed as a class project by W. L. Nasht, instructor at the Glendale High School, Glendale, Calif. For $13.50 f.o.b. Glendale, he'll ship anyone all required castings, plus piston rings and job-sheet prints. Bar stock and blanks for shafts and gears cost an additional $3. Prospective builders will have to provide themselves with a carburetor (a secondhand motor-scooter one will do), distributor points and coil, and miscellaneous stock and fittings.

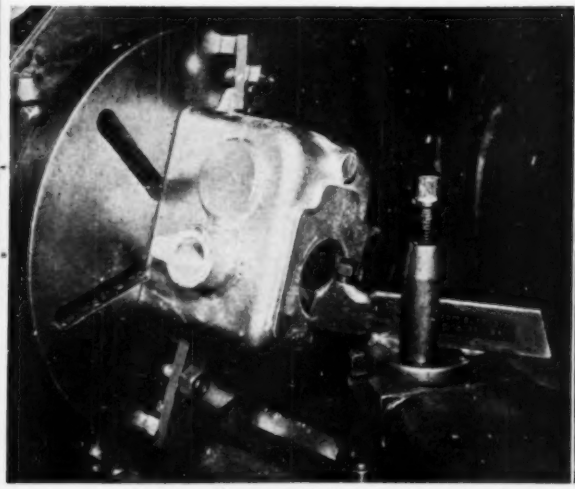
Building the engine isn't hard, although a beginner at the lathe shouldn't try it. A milling attachment is desirable but not indispensable so long as you have an "arm-strong



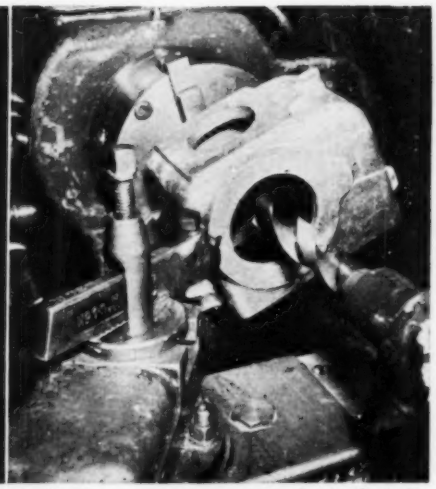
4 Cylinder is faced and bored with care. Resharpen boring bit and use a light cut and slow feed as diameter approaches 2.000″. Watch out for "bell mouth" or taper in bore.



5 Bottom of head is faced and combustion chamber turned out with casting gripped in the 4-jaw chuck. Then head is reversed, faced, and valve holes accurately located and drilled.

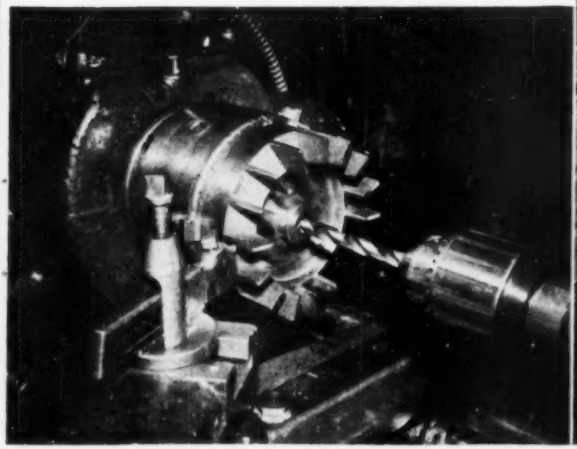


2 After bottom of the crankcase has been faced flat and smooth (surface must later seal in oil), casting is clamped to faceplate as above, and bored and faced for the cylinder.

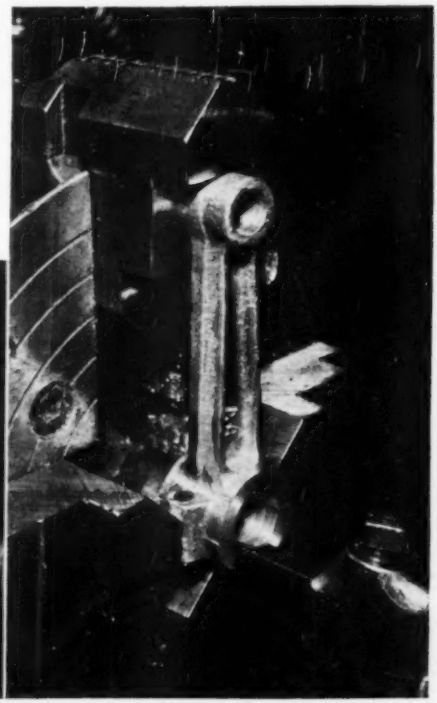


3 Given a quarter turn and chucked by bearing boss, the crankcase side is faced. A 1" drill is also run through the boss, which is later opened out to 1 3/16" for crankshaft bearing.

shaper"—that is, some files. Nasht's job sheets, planned with his students in mind, call for cutting the gear from blanks; most builders will prefer to fit ready-cut gears. Accurate machining is important, especially on the piston and cylinder, and construction shouldn't be done in a hurried or slapdash way if you expect best results. END

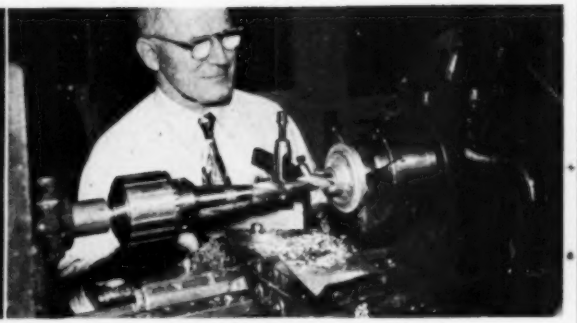


6 The flywheel is a simple turning and drilling job. Here it's held by inside chucking on back. Next it is reversed, chucked on the trued boss, and bored out to final diameter.



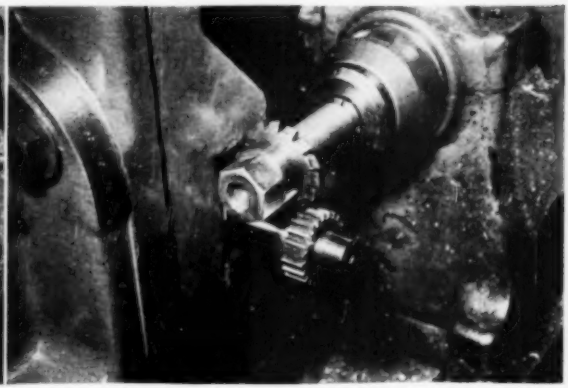
7 Con rod is finish-machined only after the big end has been drilled for cap screws, cut apart, tapped, and reassembled. The wrist-pin hole, made on drill press, is reamed to ½".

8 **Piston can be chucked** directly as shown, but it is better to mount it on a stub arbor, which gives greater tool clearance and lessens likelihood of skirt distortion from the chuck.



9 **Crankcase end plate,** here being faced and drilled by W. L. Nasht, is a simple setup. On large, through holes, practice is to run in a pilot drill, then large drill, then bore out.

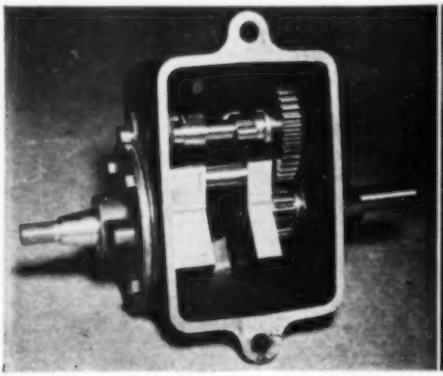
12 **Camshaft** is rough-turned, cam lobes laid out in scribed profile, and excess metal milled away. Lobes are finished with a file and emery. The camshaft here is already done.

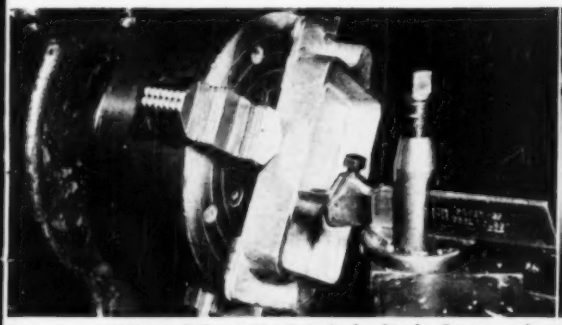


13 **Crankshaft gear,** which has 22 teeth, can be cut in milling attachment. Index head or punch marks through paper pattern locate teeth. Existing gears may also be adapted.

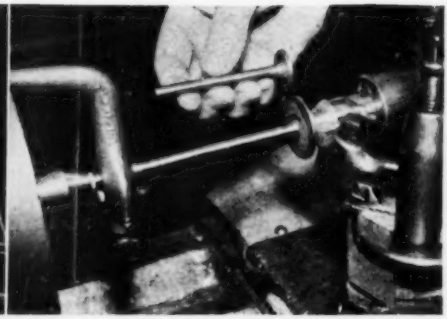
16 **Assembled this far,** engine is mounted in the lathe, bottom up and with shaft chucked. Shaft is then driven for an hour at 750 r.p.m. in a liberal bath of light motor oil.

17 **Check dimensions carefully** before final run-in with rod, piston, and rings. Leave out spark plug to prevent compression. Watch for roughness, binding, or overheating.

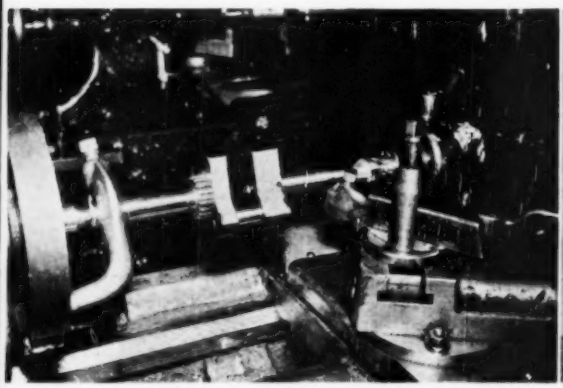




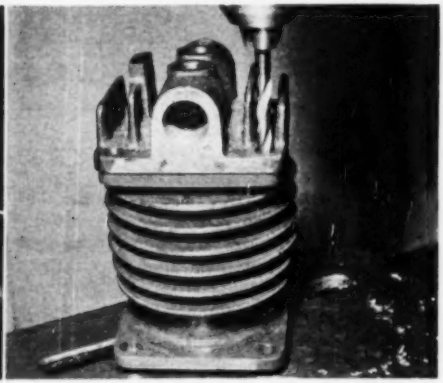
10 **Oil pan is faced** absolutely flat to make tight joint with crankcase. Toolpost and gibs must be pulled up tight to prevent ripples on edge. Six holes are then drilled in the pan.



11 **Old valves** from a Ford or Chevrolet are turned down after careful centerdrilling. Use a carbide bit if available; the stock is tough. Later, stem is crossdrilled for a retaining pin.

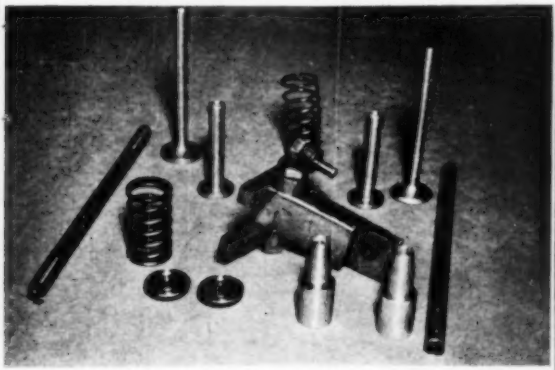


14 **Crankshaft is assembled** from five pieces and gear, using drive fits and pins. Spacer is temporarily placed between counterweights. Here a crankshaft journal is finish-turned.

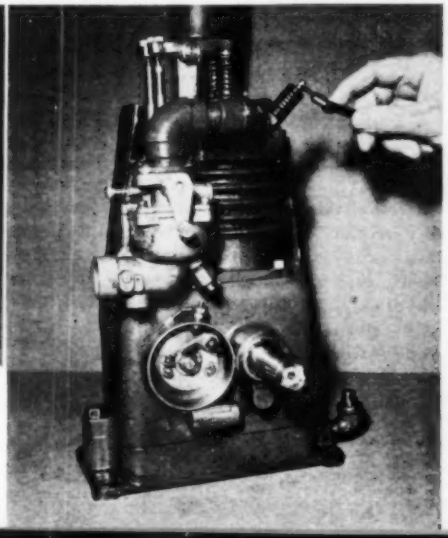


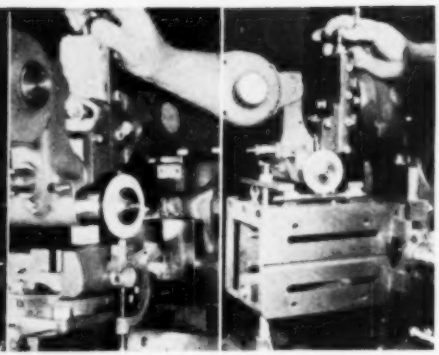
15 **Four holes** in the top of the cylinder are located with the head in place; holes in the bottom of the cylinder have already been drilled for the bolts to the crankcase.

18 **Pushrods, guides, and rockers** are all straightforward machining jobs, starting from bar or flat cold-rolled stock. Springs are wound from .062″ and .080″ music wire.



19 **This completed engine** has a 14-mm. spark plug, a secondhand Briggs & Stratton carburetor, and auto distributor points. Cooling shroud and muffler are sheet metal.



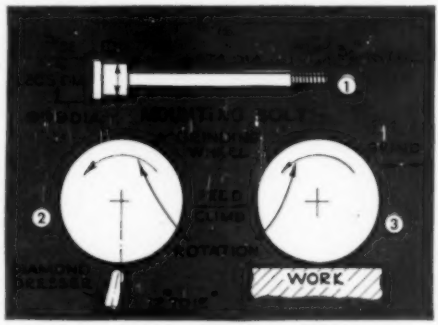


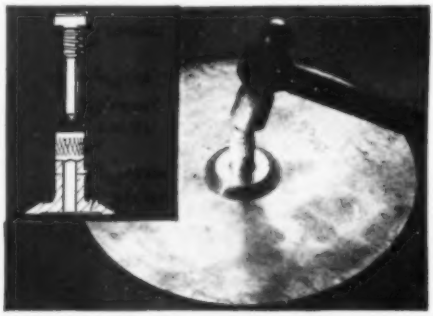
Shaper Is Surface Grinder. An ordinary shaper and a lathe tool-post grinder can be combined for precision surface grinding. Mount the grinder on the shaper as above with a special bolt (Fig. 1). Work can be secured to the knee, clamped in the vise, or held with a magnetic chuck.

Dress the grinding wheel by clamping the dresser in the vise as in the center photo. Feed the rotating wheel into the diamond with the clapper feed and across the diamond with the knee feed. Set the diamond on the wheel centerline (Fig. 2).

On work, set the shaper to feed as in Fig. 3. Take light cuts of .0005″ to .001″ and make the last one without an advance. Tie down the clapper to prevent skipping. Follow the manufacturer's recommendations as to the type of grinding wheel.

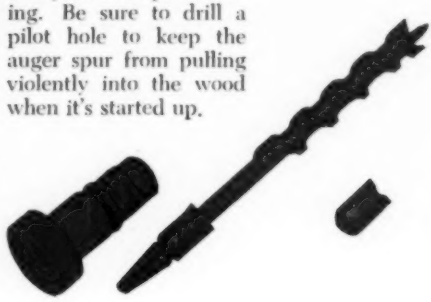
Be sure to wear goggles and use a wheel guard.—*L. W. Bonnell, San Diego, Calif.*

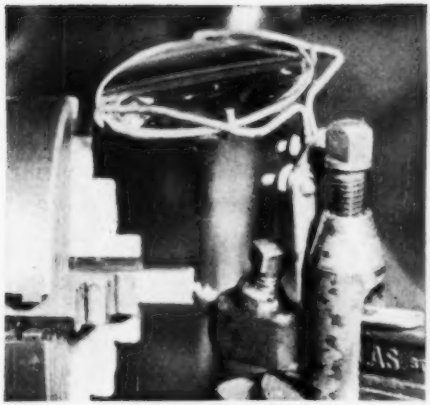




Punch Hits Exact Center. After you have laid out two right-angle centerlines to locate a hole, this punch enables you to start the hole precisely where the lines cross. Around its rim are four notches 90° apart. When these are lined up visually on the four lines, the punch is automatically centered. Turn the base from brass and ream it so the punch will be an easy sliding fit.—*Joseph Tracy, Manhattan, N. Y.*

Auger Bit Used in Drill Press. A split bushing made by drilling a short length of ½″ drill rod lengthwise and cutting it in half with a hacksaw will enable you to mount a standard wood auger bit in a drill-press collet chuck. The rod should of course be drilled the same diameter as the shank of the bit. If the drill shank is not quite round where it merges into the square taper, dress it slightly with a file so it will seat firmly in the split bushing. Be sure to drill a pilot hole to keep the auger spur from pulling violently into the wood when it's started up.

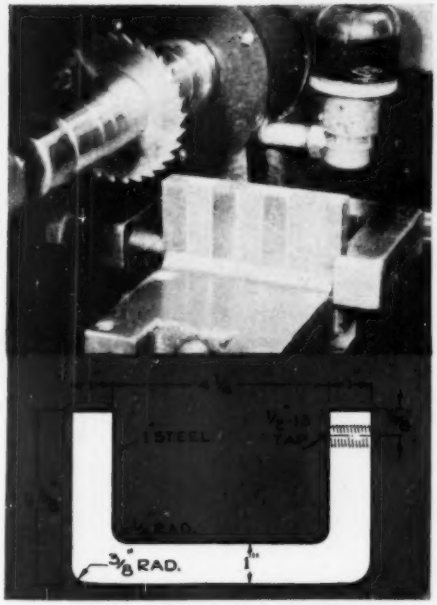




Shield Magnifies Work. An inexpensive magnifying glass mounted on a lathe as above will serve two purposes—give you better vision while doing close work and protect you from flying chips.

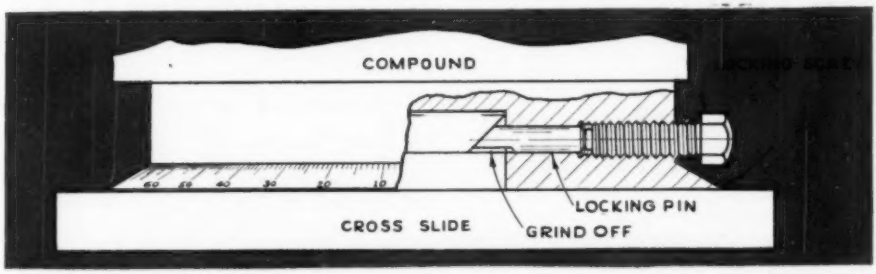
It's best to use a wire clip to hold the glass. Frequent cleaning is necessary and a rim would make this more difficult. An L-shaped bracket clamped under the toolpost screw supports the assembly. A pivoted extension on top permits adjustment.

Roll Your Own Too. Cigarette papers are often useful around the shop. To pick up a cut with a milling cutter or tool bit, hold a paper between cutter and work. You'll feel the cutter just as it contacts the work. Use as shims to true up work in a slightly eccentric three-jaw chuck, and in vise jaws to prevent marring. Once you have the habit you'll find many other uses.



Work Ganged for Milling. It's often advantageous to stack work parallel to the milling cutter and do the job with one pass. For this, the vise usually is not satisfactory, since stock variations and uneven clamping may leave some pieces loose.

The husky clamp illustrated above overcomes this difficulty. The dimensions suit it to a 3½" milling vise. It's used as shown in the photo. While the vise jaws exert pressure in one direction, the clamp works in another. This two-way clamping prevents movement.—*J. C. Magee, Schenectady, N. Y.*



Stopping Lathe Chatter. In small lathes, the pins that lock the compound rest on the cross slide may cause chatter if they ride on the collar below the inverted cone. To check for this, take off the compound, clean carefully, coat with a film of oil, restore it, and draw up the locking screws. If the oil is drawn in instead of being pushed out, it's a sure sign the pins are riding. The remedy is simple: grind .010" to .015" from the lower edge of each of the pins.—*L. L. Sevebeck, Westfield, N. J.*

Acetic acid shortstop helps prevent developer stain and doubles life of fixing bath. Prints can be left temporarily in shortstop and then be transferred in batches to the fixing bath.

Print Your Pictures for a Lifetime

They'll last practically forever if you fix, wash, and mount them carefully. Here's how to do it.

By Kenneth M. Swezey

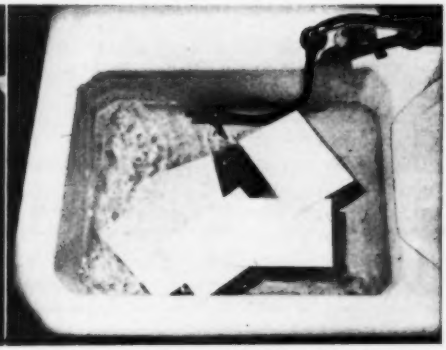
SOME rainy day half a century from now, your grandchildren may start rooting around in the attic. Chances are, they'll dig out an old album or dusty box of photos, among them several you proudly pulled from the developer away back in 1949.

The youngsters will grin, perhaps laugh aloud, at the strange costumes. But what about the photos? Will they be stained and faded—like those you've probably seen in your own grandpop's attic? Or will they still be bright and crisp?

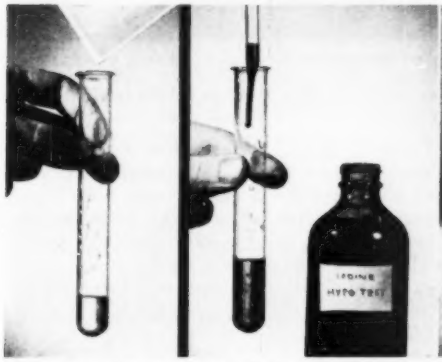
It depends on you. With care, you can make prints that will last as long as the paper on which they're printed. But you must pay exacting attention to the drab jobs of fixing, washing, and mounting.

When you watch a print in the fixing bath, nothing seems to happen. But don't let that fool you. The hypo must dissolve all undeveloped silver salts, or they'll eventually cause overall darkening of the print. In turn, thorough washing is required to carry away the hypo. If any remains, sulphur in it will react with the silver image, producing yellowing and fading.

Rock the fixing tray frequently and manipulate prints occasionally with tongs. Make sure the solution reaches the surface of each print.



Washing carries away hypo and soluble silver compounds from paper. The circulating system must keep fresh water in contact with prints.



Iodine-starch test detects hypo remaining on prints. Drip water from print into tube, add solution. If it loses blue color, hypo remains.

Ammonia solution, used as described in text, removes last trace of hypo. This will help you keep valued prints bright indefinitely.

If agitated constantly, a single print should fix in about a minute in fresh hypo. But under ordinary conditions, it's best to leave prints in the fixer about ten minutes.

Unfortunately, there's no easy test to tell when hypo has reached the end of its useful life. The best you can do is remember that the conservative life of typical acid hardening solutions, such as Kodak F-1 and Ansco 201, has been determined by experiment. Under normal conditions, a gallon should fix about 60 eight-by-tens (or their equivalent) that have been rinsed in plain water, or 120 such prints if acid shortstop is used. Make this shortstop by adding 1½ oz. 28-percent acetic acid to 32 oz. water. Swish prints in it for at least five seconds.

A rapid flow of water doesn't greatly speed up the washing time of prints. But be sure a supply of fresh water constantly circulates around the prints. Wash single-weight prints at least 30 minutes, double-weight at least an hour.

One of several chemical tests will tell you when a print has been safely washed. The iodine-starch test, for instance, detects 1 part hypo in 2,500 parts of water. A formula recommended by Defender consists of three solutions that are mixed just before using. The separate solutions will keep indefinitely in well-stoppered bottles. An amber bottle preserves the mixture briefly.

Make solution A by dissolving ¼ oz. potassium iodide and 50 grains iodine crystals in ¼ oz. water; add water to make 4 oz. Make solution B by dissolving 10 grains soluble starch in 4 oz. water; heat to boiling and cool. Solution C consists of ¼ oz. concentrated hydrochloric acid diluted with 3¾ oz. water. To make the test solution,

add 18 drops of solution A and an equal amount of solution C to ½ oz. of solution B; add water to make 4 oz.

Use by letting water drip from a print into a tube and adding an equal amount of test solution. If the blue test solution loses its color, hypo remains in the print.

Even with prolonged washing, a minute amount of hypo inevitably clings to a print. Ordinarily, you needn't worry about this. For valued prints, you can remove this last trace with a solution that changes the hypo to a compound that washes out more readily.

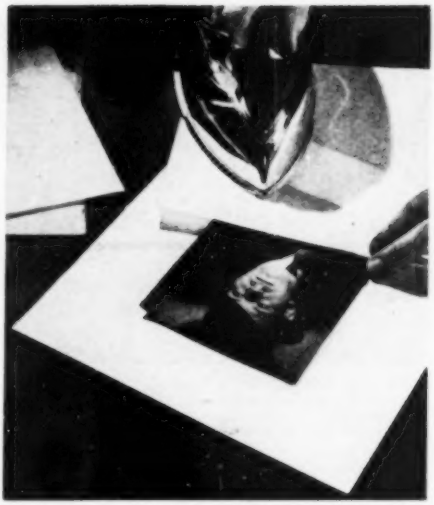
Make this by mixing 4 fl. oz. hydrogen peroxide and 3¼ fl. oz. of 3-percent ammonium hydroxide (ammonia water) with 25 oz. water. After washing the prints for the usual time, immerse for six minutes in this solution. Wash ten minutes longer.

To make a very delicate check on the existence of traces of hypo in your prints, process a blank piece of photographic paper along with the prints. After washing has been completed, cut a strip from this paper and immerse it in a 1-percent solution of silver nitrate. (Be careful: this is corrosive and poisonous.) After immersion of the strip for several minutes, compare with the wet paper from which it was cut. A yellow-brown tint indicates the presence of hypo.

Even when prints are well fixed and washed, hydrogen sulphide in the air may cause them to yellow and fade. This can largely be prevented by treating the print in a solution that coats the silver with gold.

Make the solution by adding 2½ fl. drams (about ½ fl. oz.) of 1-percent gold chloride stock solution (made by dissolving contents of 15-grain tube in 3¼ oz. water) to 24 oz. water. Dissolve 145 grains of either sodium or potassium thiocyanate in 4 oz. water. Add slowly to the first solution while stirring rapidly.

Immerse the washed print in this solution for ten minutes at 68° F., or until a faint change in image tone (toward bluish-black) takes place. Wash ten minutes. END



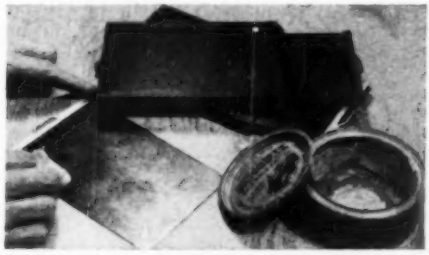
Dry mounting tissue is safest way of mounting prints. Most pastes contain a certain amount of sulphur. This will cause prints to fade.

Silver nitrate solution gives a very delicate check on hypo in prints. Immerse a piece cut from blank photo paper processed and washed along with prints. If the immersed strip shows a yellow-brown tint, as indicated below, the prints all should be given further washing.

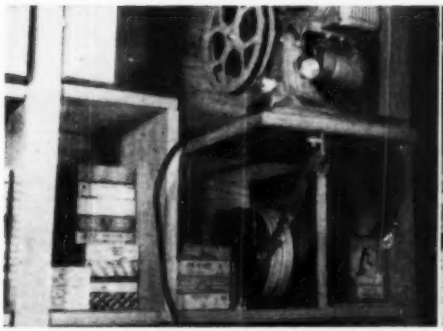
PHOTO IDEAS AND EQUIPMENT

Gives Choice of Neg Size. An adapter kit offered by Eastman enables the owner of a Kodak Tourist® camera to take pictures in four negative sizes—8, 12, or 16 on 620 film, or 8 on 828 black and white or Kodachrome®. For the latter, the kit includes spool adapters as well as a mask. A special back meters the film for the different neg sizes, and view-finder masks cut down the image as necessary.

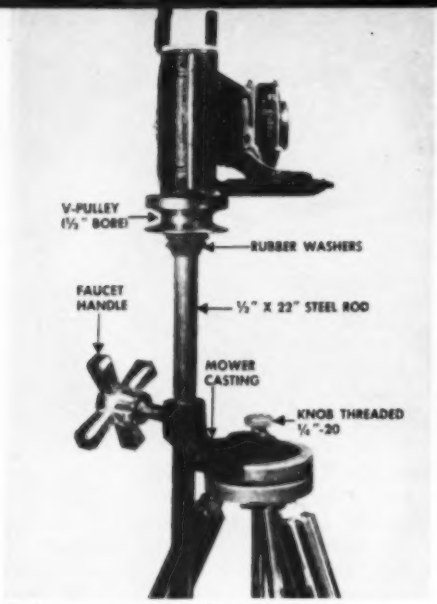
Movie "Box Camera." The new 8-mm. Cine-Kodak Reliant Camera® was especially designed to be as easy to use as a box camera. There are no sprockets to worry about while loading the roll film, and a prefocused 13-mm. f/2.7 Kodak Cine Ektanon® lens requires no adjustment for subject distance. Taking speeds are adjustable from 16 to 48 frames per second, and the finder indicates parallax correction.



Keep Dust Out of Holders. Do your negatives look as if they have measles? If so, dust in the film holders may be the cause. To avoid this, dust the holders occasionally with a cloth or a soft-bristled brush, making sure you get dust out of the thin metal film guides. At the same time, wax the dark slide and wood portions of the holder. Wax helps keep the slide free of dust.—*C. W. Hamilton, Seattle, Wash.*

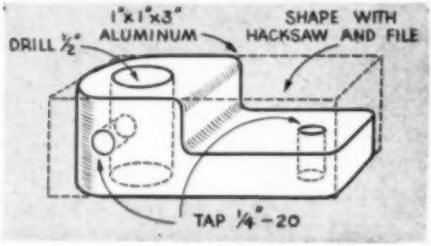


Projector Fits into Bookcase. In most bookcases, the shelves are too closely spaced to allow room for a movie projector. However, you can cut out a section of one shelf and lower it as at right above. A hinged door under the shelf swings up and is held by a spring-lock bracket to provide a platform for the projector in use. Reels and other items are stored behind the door.—*Donald B. Terrana, Brooklyn, N. Y.*



Pulley serves as platform for camera or conventional pan-tilt head. Put the pulley on the end of the rod and secure it with setscrew.

Turn ¼"-20 screw into hole drilled and tapped in end of rod, letting it project ½". Rubber washers cushion head if it falls accidentally.



Offset bracket can be shaped from aluminum or other metal if mower casting isn't available. Faucet handle locks rod in desired position.

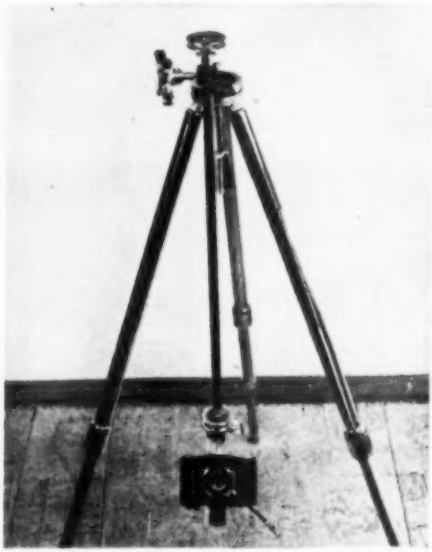
Elevating Head Improves Tripod

ORDINARILY you turn to a camera store for photo accessories. But this elevating tripod head is different. Its parts all came from a hardware store.

A search of your home and shop may turn up most of them—or at least satisfactory substitutes. Besides the items shown at the left, you need only a couple of ¼"-20 machine screws. Cut the heads off these. One goes in a hole drilled and tapped in the end of the elevator rod, and the other in the faucet handle. Setscrews secure the one in the faucet handle.

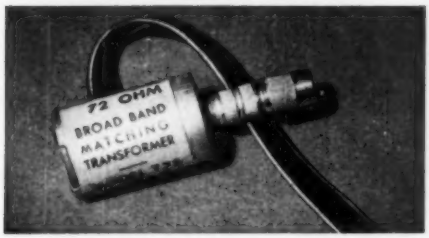
A discarded lawn mower is the source of the casting that offsets the elevator rod. It originally held one end of the roller. Drill and tap the sidewall of the large hole for the machine screw that you've fitted into the faucet handle.

If you wish, you can place a pulley and tripod screw at both ends of the elevating rod as shown below. This allows a wide range of camera positions up and down. On occasions, the elevator is handy as a light stand.—*John P. Arnold, Doylestown, Pa.*

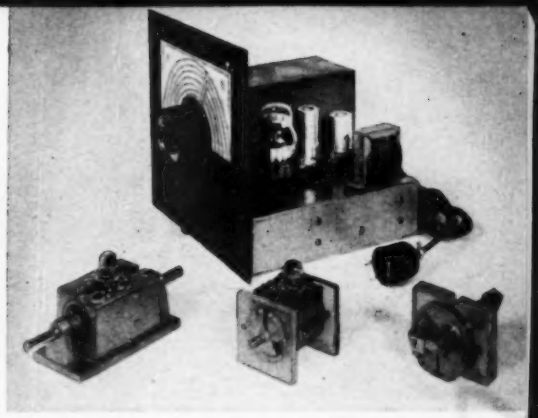


Off-the-floor shots are taken with ease. Just drop the elevating rod and fit a pan-tilt head to a similar mounting on the bottom end.

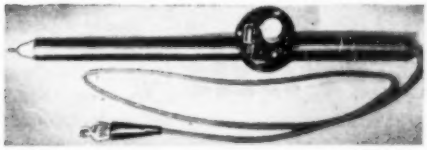
NEWS IN ELECTRONICS



Transformer Matches Lead-in. A small transformer made by Workshop Associates, Newton Highlands, Mass., feeds from 72 ohms at one side to 300 ohms at the other. With it TV set owners can match coaxial cable to 300-ohm input terminals. It also can be used in reverse to match 300-ohm twin-lead to a 72-ohm input. Mismatching between antenna and receiver often accounts for weak signals or interference.



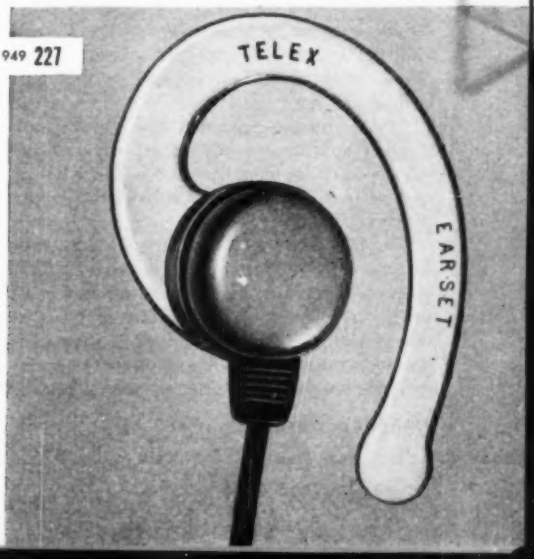
Converter Receives UHF. Television sets need not be made obsolete when new ultra-high frequency channels are opened for video broadcasting. A converter developed by Stanford Research Institute steps down transmissions in the 475 to 890-mc. spectrum to the lower frequencies that present-day sets can receive. The converter is connected between the antenna and the antenna-input terminals of the receiver.

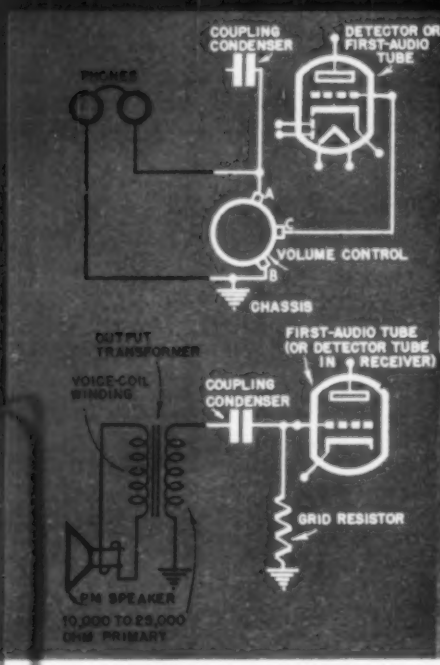


Neon Lamp Checks 30 KV. An inexpensive voltage checker using a neon lamp instead of a meter has now been adapted for high-voltage applications by Industrial Devices, Inc., Edgewater, N. J. It will read up to 30,000 volts.

Splicer Joins Recording Tape. Editing of magnetically recorded tapes may be made easier through the use of the splicer shown below. It cuts and rejoins tape ends by means of a plastic weld without adding to the thickness of the tape. Prestoseal Manufacturing Corp., Long Island City, N. Y., makes the unit to sell at $65.

Earset Eliminates Headband. No band or strap is needed to keep the new Telex Earset® in place. A plastic frame slips onto either ear to hold the earpiece in position. The single-cord connection also allows the user greater freedom of movement. Telex Inc., Minneapolis, manufactures the device. The 5′ cord is removable.





1. Headphones or even a loudspeaker will often replace a crystal microphone. Drawings at the left show connection to common radio circuits. Above, phone is used to test amplifier.

Radio Parts from Your Scrap Box

Though most components are designed for particular jobs, you can make many of them double up in a pinch.

By Frank Tobin

IF YOU'RE a typical radio experimenter, you know what it means to be stuck for a vital part when the stores are closed. Since many amateurs do their work nights and holidays, it happens to a lot of people. Next time you run into that situation, take a look in your spare-parts box. You may not see what you're looking for, but perhaps you'll find at least a temporary substitute for the part you need.

The first rule for making spare parts work for you is to keep them in good order. Separate components by type and value, and never, never toss in a defective part without marking it. If you know a condenser is shorted or open, throw it away. A transformer with one winding open is worth saving, however, if you tape on a note that tells what's wrong with it.

With a fair selection of resistors you should never be too badly stuck for a particular value. Connect smaller ones in series to add up to the total you want, or in parallel to get a lower value. The same is true of condensers, but in reverse.

Headphones and loudspeakers are usually thought of as reproducers but they will also operate as microphones in a pinch. A single phone will give fair volume with two stages of amplification, as in an AC-DC receiver; both phones will do even better. For such use, connect it as shown in the upper sketch. In some cases it may be necessary to make the connection at terminal C of the volume control instead of terminal A. If the amplifier has a microphone-input jack, you'll use that, of course. As you can see in the diagram, no special coupling is needed; the condenser and volume control are already in the set.

To use a permanent-magnet speaker as a microphone you need a transformer to match the voice-coil impedance to that of the amplifier grid. The best bet is to use a regular intercom transformer which has a secondary winding in the neighborhood of 70,000 ohms. Lacking this, try an ordinary output transformer, selecting the highest primary impedance available. Wire them as shown in the lower sketch of Fig. 1; black lines represent the parts added to those already in the set.

The humble wafer socket has the makings of a test-point adapter (Fig. 2). The wafer socket must be of the same base type as the tube to be checked. Invert the socket, push in the tube, and plug both tube and test socket into the socket on the chassis. It may be necessary to clip the prong sleeves on the wafer socket to allow the tube pins to extend through. Bend back the soldering lugs.

You may find yourself short of test prods at a bad time. That's nothing to worry about if you have two mechanical pencils around the shop. These pencils make good substitutes for prods (Fig. 3). They should have plastic barrels, or you may find yourself holding a piece of high voltage. Make sure that a good contact exists between the metal ferrule on top of the pencil and the metal tip. Wedge the wire from the meter under the eraser cap or solder it on.

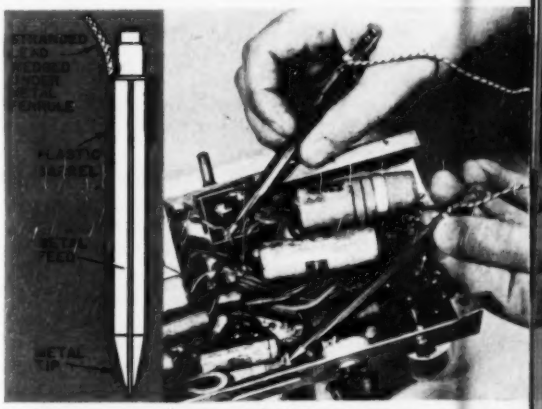
Coil Forms from Spools

An ordinary wooden pencil, by the way, will make a fine core for a high-frequency choke. Such chokes are widely used in FM and TV receivers and in other high-frequency equipment. Leave the graphite in the pencil; it takes the place of a powdered metal core. Saw off a 1″ piece and wind the coil around it.

Other substitute coil forms can be salvaged from flashlight batteries or a sewing box (Fig. 4). In the former case, slip the cardboard sleeve off the cell; in the latter, use a wooden spool from which the thread has been removed. Finished coils will stay neat longer if they are coated with liquid coil dope.

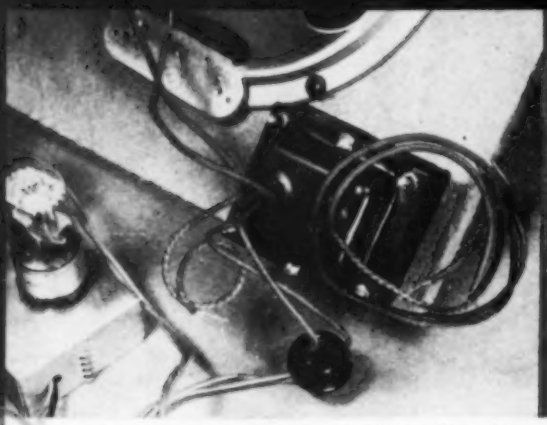
Have you ever thought of employing a power transformer as an output transformer? Even a defective unit can be used at times. In Fig. 5 a fairly common transformer type is shown in this unconventional application. Using half the high-voltage winding between the plate and B plus, and em-

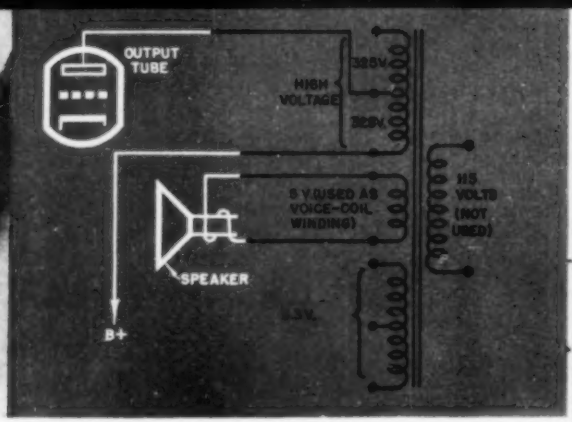
2. Test-point adapter, easily made from wafer tube socket, allows you to check voltages at the tube instead of turning chassis over.



3. Need a pair of test prods? Try using mechanical pencils. Be sure they have plastic barrels, for the metal parts may be "hot."

4. Coil forms can be improvised from many common objects. Windings must, of course, be figured in relation to diameter of the form.





5. A power transformer can be used in place of an output transformer. It's an expensive substitute, but it will work nicely until you get a chance to put in the correct replacement unit.

ploying the 5-volt rectifier winding for the voice coil gave a surprisingly good match between a 35L6 power tube and the speaker. For other tubes and speakers you can try a number of other combinations. The 6.3-volt secondary, for example may be used in place of the 5-volt one. Also try the entire high-voltage side, or half the 6.3-volt winding.

A push-pull audio transformer can be made from two single-tube transformers if they're wired in series as shown in Fig. 6. First try connecting one grid and one ground lead together at the center tap. This may not be the best arrangement, however, so experiment with others.

By juggling the filament windings on an old power transformer made for 5-volt and 2.5-volt tubes, you can obtain 6.25 volts. This means you can use the transformer in a circuit employing modern 6.3-volt tubes. Note, however, that you no longer have a 5-volt tap for the rectifier, so you'll have to use a 6X5 or similar 6.3-volt rectifier, heating all tubes off one winding.

Subs for Filter Chokes

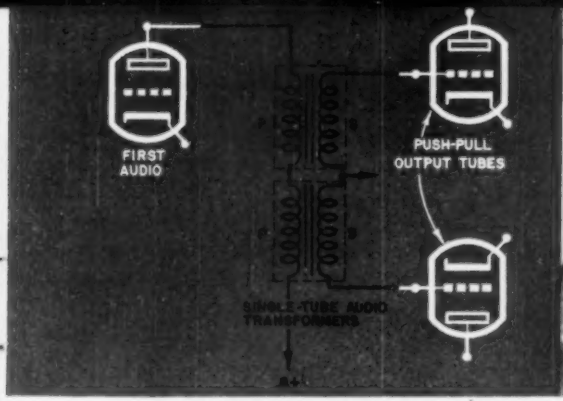
It often happens that a serviceman or experimenter is stuck for a filter choke. It may occur when you replace a field-coil speaker with a permanent-magnet one, for the field coil frequently doubles up as a choke. In a pinch you'll find a filament transformer is a pretty good substitute. Lacking a filament transformer, try using the primary winding of an output transformer in place of the missing choke. Both applications are pictured in Fig. 8.

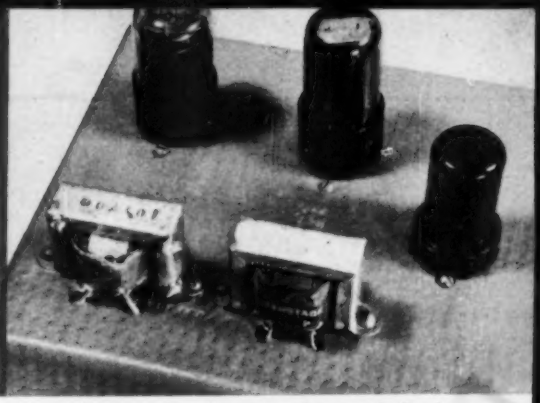
Figure 9 illustrates another possible transformer dodge. The photo shows a universal output transformer being used to feed 6.3-volt tube heaters. This won't work in all cases, but by trying the various taps on both primary and secondary you may be able to find a combination that steps down 115 volts to a value very close to 6.3. Test the voltage on an AC meter before risking the tubes. The transformer should be rated at 8 to 10 watts or higher; smaller ones will overheat. The voice-coil winding goes to the tube filaments while the primary is connected to the 115-volt line.

Selector Switches

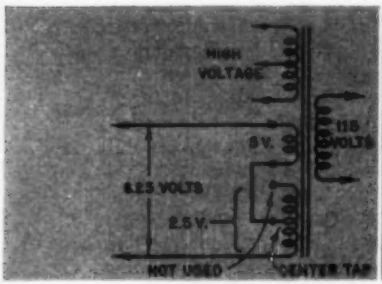
If it's a low-voltage switch you want, you don't have to hunt very far. A few nickel-plated wood or machine screws will do the job nicely, as pictured in Fig. 10. The setup shown is a test circuit in which a universal output transformer is used to feed a number of different speakers. Instead of soldering and unsoldering a number of connections to find the best match, make a selector switch by driving the required number of screws into a scrap of wood. Place them in an arc arrangement so that the moving arm—which can be a flat brass or plated bracket about 1½" long—will make contact with each screw head. A small wooden knob can be attached at the end opposite the pivot screw.

Parts substitution of the kind described above may not save you much money, but it will save a lot of time and energy. Obviously it doesn't make sense to buy a $3 power transformer in order to replace a filament transformer that costs half as much. But if you happen to have the more expensive unit gathering dust, you won't lose anything by putting it to work. If this makes it possible to finish the building or repair job you're doing, it will often put you ahead of the game. END

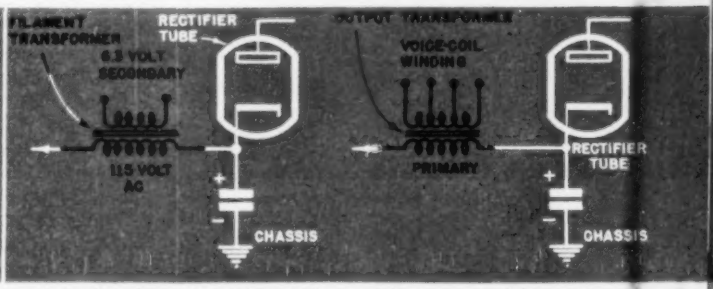




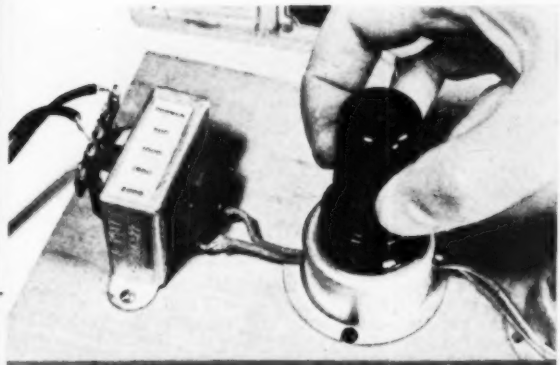
6. Two single-tube audio transformers make a neat replacement for a push-pull transformer. Depending on transformer make, method of connection may vary; try different combinations.

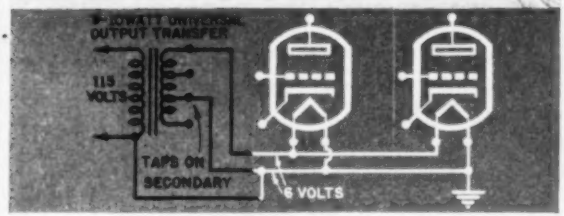


7. Old transformers for 2.5 and 5-volt tubes can be used in modern circuits with 6.3-volt heaters. This arrangement gives 6.25 volts.

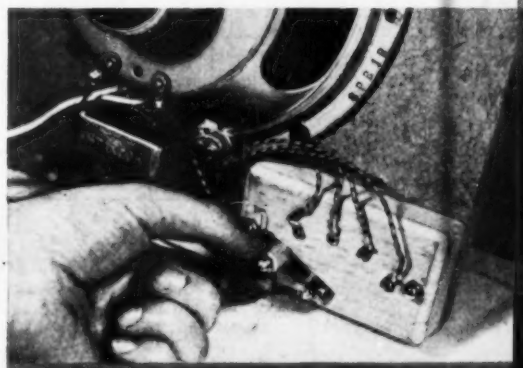


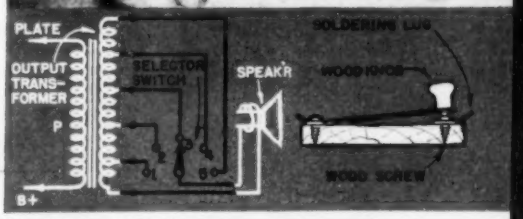
8. Filter chokes may be improvised from either filament or output transformers. One winding isn't used; it can even be open or shorted.





9. Heater voltage can be furnished in many ways; one of the more unusual ones is to use an output transformer. Test tap combinations.





10. Selector switches are a cinch to make. A couple of screws and a flat metal arm do the trick. Use soldering lugs for the contacts.

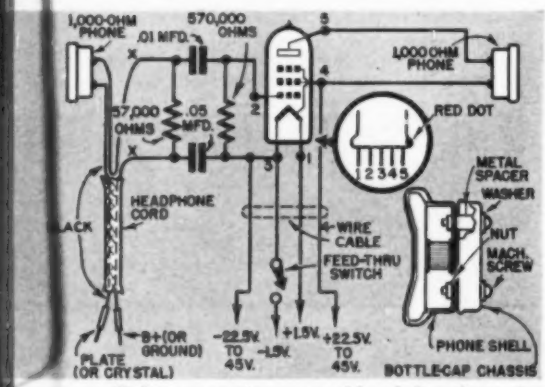
Amplifier Fits On Headphone

Get more stations at better volume on your crystal and one-tube receivers by using amplifying phones. They'll work with any set.

You'll listen more comfortably to your crystal and one-tube receivers with a pair of amplifying headphones. And you'll also find them helpful for signal tracing, checking phono cartridges, and the like.

This amplifier, built on an ordinary pair of 2,000-ohm phones (each phone is 1,000 ohms) will work with any type of set. The whole amplifier, less batteries, fits into a metal bottle cap measuring 1⅝" across by only ½" deep. This bottle-cap chassis is bolted to the back of one phone. Since the cap is in effect grounded, you'll lessen the chance of shorts if you line it with cellulose tape. Also tape the bolts and spacers.

Initially the two sides of a pair of headphones are wired in series, with the common wire running down to the yoke and back up the other side. To connect the amplifier, remove the leads from the phone carrying the bottle cap and connect them to the points marked X in the diagram. The two phone terminals are then wired to pins 4 and 5 of the tube.—*Albert Rowley, Manhattan, N. Y.*

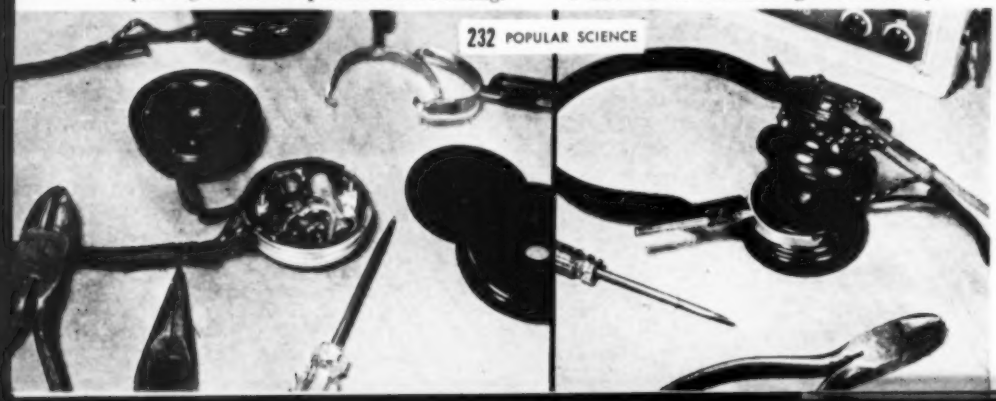


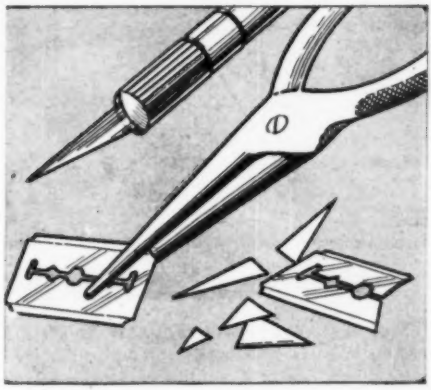
Tube connections are soldered directly to the pins. Use a small iron and try to solder each joint quickly; too much heat may cause damage.

Insulate the bottle-cap chassis with tape. The holes in back are for mounting; drill two more in the rim to clear battery and phone cables.

All parts, including tube, are mounted inside the bottle cap. Battery and phone wires are taped together to keep them from snarling.

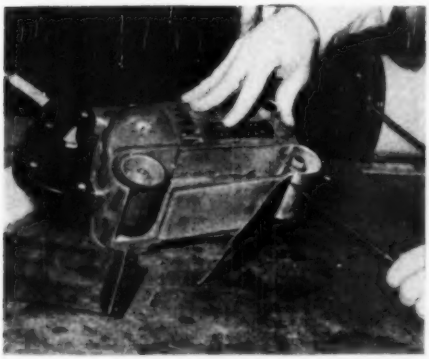
Amplifying headphones complete except for the batteries. Use a 1.5-volt flashlight cell and a 22½- or 45-volt hearing-aid B battery.





New Knives from Old Blades

For collet-type knives, such as the one pictured above, you can make yourself a supply of new cutters by breaking old razor blades. Hold the blade with pliers and snap off pieces with needle-nosed pliers. By careful breaking, you can get a variety of shapes. *–G. E. Harrington, Manhattan, N. Y.*



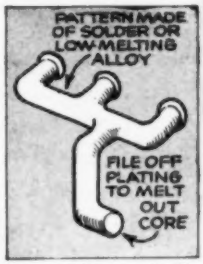
Soft Shoe for Final Sanding

On final sanding jobs, portable belt sanders tend to leave fine dents in the surface unless the metal shoe is replaced by a woven asbestos shoe. The extra thickness of the belt at the lap causes the dents. An asbestos shoe, sold by the manufacturers of the sanders, absorbs the shock when the extra thickness strikes. A temporary soft shoe can be made from heavy cloth such as furniture webbing. Cut it to the length and width of the metal shoe it replaces. Either a temporary or a factory-made soft shoe should be used only for finishing work after the rough sanding has been done with the metal shoe in place.*–James B. Leeth, Cullman, Ala.*

Cuts Circles from 3/4" to 12"

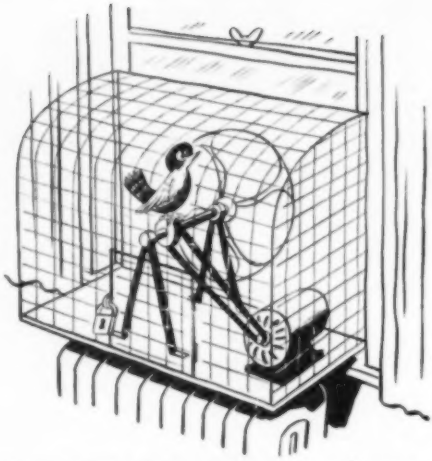
The McKelvey hole and circle cutter handles metal up to ½" thick and fiber, wood, and plastic up to 1½". By adjusting the rake of the cutter, noise and chatter are minimized when working on materials of varying hardness. Flat-tip screws secure the various parts, the pilot drill being pressed firmly against the side of the cutting arm. It takes any ¼" cutter and has a height of 2¼". The attachment fits any standard drill press and is priced at about $8 by the Sunset Equipment Company, of Los Angeles.

Solder Subs for Tubing



I needed a pair of manifolds for a model of a World War I airplane engine and couldn't get copper tubing of the proper size. Using wire solder, I bent it to the shape shown here. Then it was carefully coated with graphite and copperplated (PS, Dec. '47, p. 213). After filing through the copper at one end, I melted out the solder core by heating it in a gas flame. Before copperplating, it's necessary to coat lead-base metals with graphite. Otherwise, a soft, spongy coating of copper is likely to result. If the tubing you want to simulate needn't be hollow, you can carve it of wood and then copperplate it. *–Freddy Mitchell, Simsboro, La.*

What's Your Ingenuity Quotient?



Fan Gets the Bird. Now that winter is coming on, I've sublet the window-fan cage to the canary, after first cutting a door in the screen. He likes the new accommodations so much that I'm wondering what will happen when his lease expires next spring and he must return to smaller quarters.—*M. H. Bates, Montgomery, Ala.*

Shelling peas for our deep freeze is a production-line operation now. We use a clothes wringer. The peas are packed in ice to make them firm. Then they're fed into the rollers blossom ends first. As the rollers take hold, the other end of the pod is pinched, and the peas come popping out. —*Ruth R. Smith, Brookline, Mass.*

Be Kind to the Little Wife. If your wife is short, this rig will enable her to reach the clothes line and at the same time hang clothes high off the ground. Install the cross bar so it pivots easily, and drill a series of holes in the diagonal brace. Mrs. Four-by-Five can then lock the line at the desired height with a pin through the brace.—*Hattie H. Holt, Springfield, Ill.*

It's Oil Right. To keep from running out of fuel oil, I tapped a hole in my tank 7″ above the original feed line. Then I put in a pipe nipple and ran ½″ copper tubing to the regular feed line beyond the valve. With the valve shut off, my furnace gives me several days' warning before I *really* run out of oil.—*E. LaCross, Iron River, Wash.*

Have you pulled off a smart one lately? We will pay for acceptable contributions showing ingenious solutions of problems in the home, shop, garage, or camp. It doesn't matter if it's wacky—if it works. Use government postcards only. Contributions cannot be acknowledged or returned.

After fish is sketched on block of wood, waste stock is cut away with a saw. First shaping of the body is done with large gouge. Cuts are made partly across and partly with grain.

Body is chiseled to a rough shape and then finished with gouges and rasps. Tail and fins are separated with a rattail file. Note the hand-fitting tool handles Fitz-Gerald made himself.

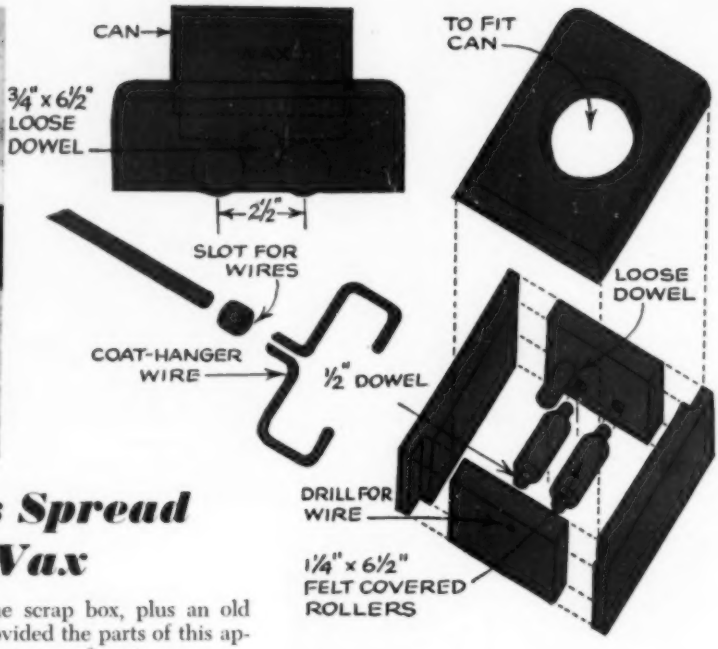
Starting with coarse-grained paper, tool marks are worked out. Final sanding is with 3/0 paper. Strokes follow line of object and are not necessarily with the grain.

Finished work is mounted on an aluminum peg set in a block of stone. Wood is finished with two coats of shellac cut 50 percent with alcohol. Wax polishing completes the job.

Cherry Grain Forms Fish Fins

RIPPLING as though viewed underwater, the wood grain in this carving is a basic part of the design. Note how the grain lines end in the spines of the dorsal fin. Clark Battle Fitz-Gerald, Kirkwood, Mo., commercial artist who carved this perch from cherry wood, says he sometimes spends as much time studying grain structure as he does in carving. His favorite woods are walnut, cherry, and osage orange.

He uses the usual woodworking tools—saws, chisels, gouges, rasps, and files to do his carving. Fitz-Gerald also made the mallet and the handles of the other tools. The mallet, of osage orange, is so tough that nails can be driven with it.



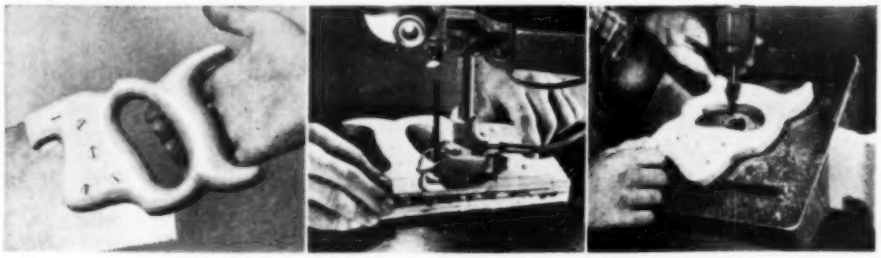
Rollers Spread Floor Wax

PIECES from the scrap box, plus an old broom handle, provided the parts of this applicator that holds a can of paste wax.

Dimensions for the rollers are given in the drawing. Build the box to conform to them. Cut the hole in the top for a loose fit around the can. The two larger rollers are covered with felt while the smaller one is left bare. This free roller acts as a stabilizer, bearing most of the weight of the wax and preventing the felt-covered rollers from taking up too much wax. Loosen the wax from the can before placing the inverted can in the top of the applicator. Leave the can in place as a protective covering for the wax.

I turned the rollers on a lathe. However, dowels or lengths cut from a rolling pin will do just as well. The wire bracket was bent from a heavy wire coat-hanger and the ferrule taken from an old mop.—*Bernard Cohen, Toronto, Canada.*

Replacement Saw Handles Cut from Plywood



You can duplicate a favorite saw handle by cutting a blank from glued-up scraps of ¾" plywood. After gluing four pieces of hardwood plywood face to face, trace the outline of the new handle from the old one. Scrollsaw to the outline (center photo above) and then use rotary files chucked in a drill press to round the edges. Tilt the table at various angles to shape the edges. Smooth the work with sandpaper. Use a ripsaw to cut a slot for the blade and drill for mounting screws.—*E. M. Love, Palmdale, Calif.*

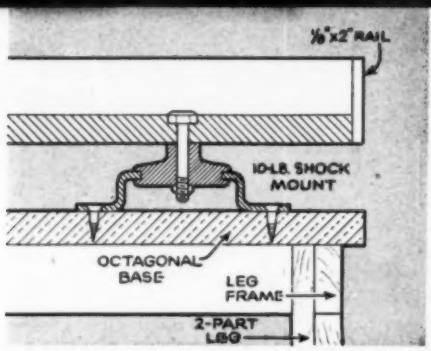
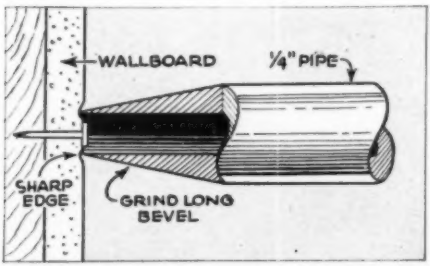


Table Holds Portable Washer

After repeated efforts to buy a suitable table for my portable washing machine, I decided to build one to my own specifications. Here it is.

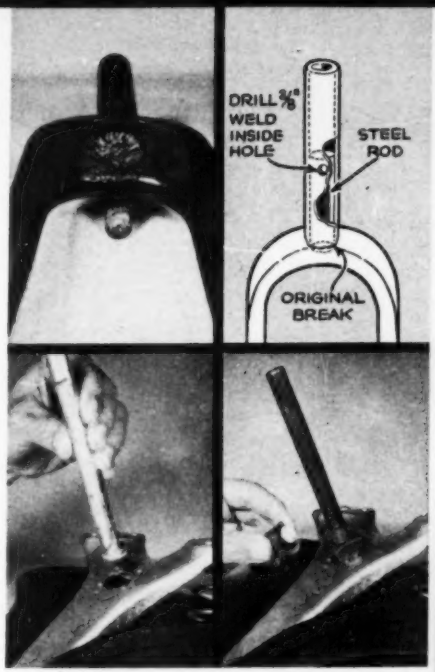
An octagon shape was adopted to save space and avoid sharp corners. Legs were built up of two pieces. This made it unnecessary to cut a rabbet for the leg frame. An octagonal shelf mortised into the legs provides rigidity for the structure.

Shock mounts under the table face eliminate vibration and rubber pads on all the legs reduce the "walking" action. Instead of forming ⅛" wood around the top as a rail to retain the washer, you could use sheet metal.—*W. L. Taylor, Washington, D. C.*



Tool Cuts Wallboard Free

This tool makes it easy to remove wallboard. It's made by grinding a long bevel on one end of a short piece of ¼" pipe. When the tool is set over a nail and hammered, the sharp edge cuts through the wallboard, freeing it from the nail. The board can be nailed back at a different spot.—*John H. Dunnewin, Grand Rapids, Mich.*



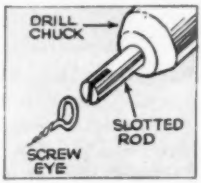
Hints on Repairing a Tricycle

Some tricycles aren't as well built as they might be. As a result repairs are often necessary. The procedures I followed in two such jobs may help others.

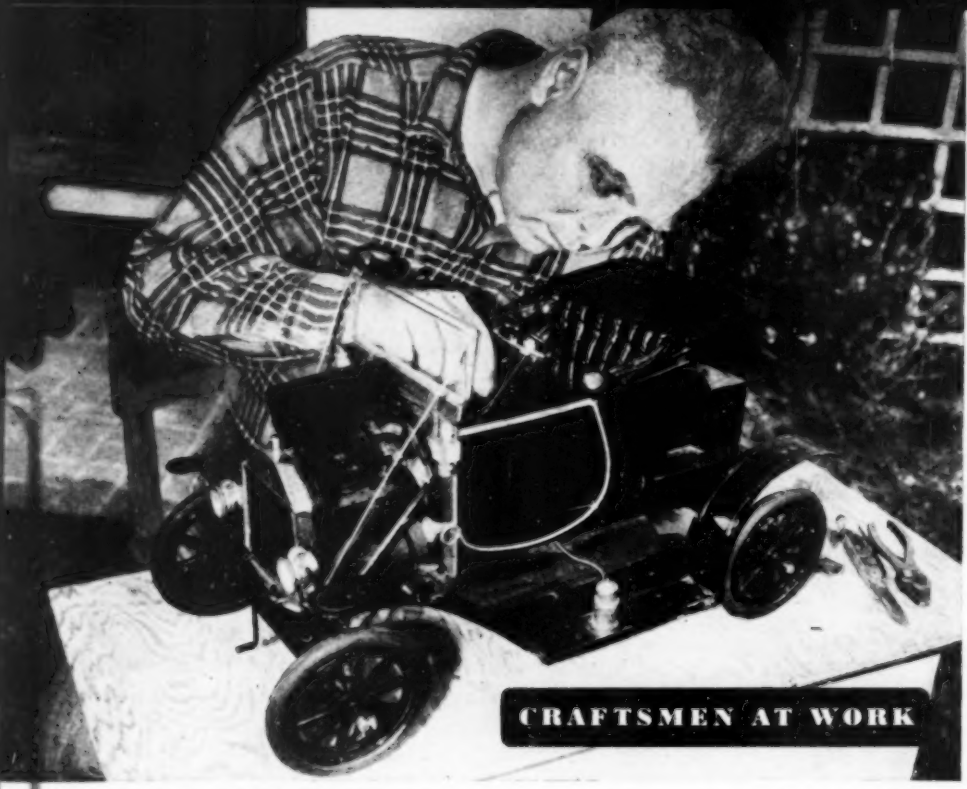
First, the fork broke at the point where the neck joins the wheel arms. Since the neck is just tubing, it soon broke loose again when welded. To strengthen it, I pushed a length of close-fitting steel rod into the tubing. Then I welded inside two ⅜" holes drilled in the tubing, around the original break, and also underneath.

When the seat column broke loose from its metal plate, as in the lower left photo, I decided against welding. Instead, I cut the head from a carriage bolt of the proper diameter and clamped the plate between nuts.—*A. C. Kubitz, Millbrae, Calif.*

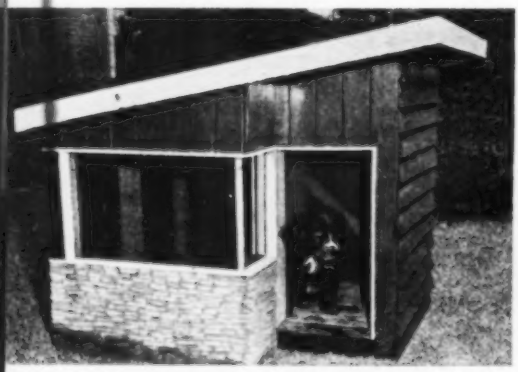
Slotted Tool Sets Screw Eyes



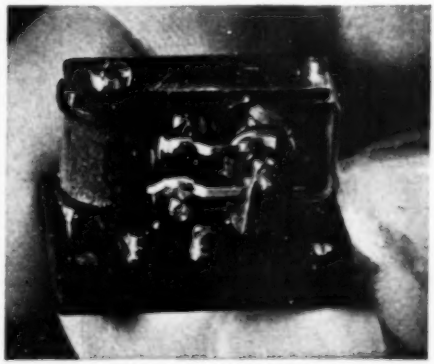
This handy tool saves time and work in driving all kinds of screw eyes and hooks into wood. Make it by cutting a 5" length from ¼" steel rod. Slot the end with a hacksaw and widen the slot by forcing the legs apart with a screwdriver. Chuck the solid end of the tool in a brace or drill.



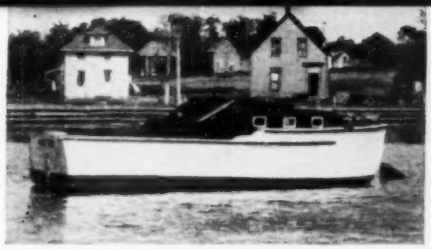
Hot Rod, 1911 Model. The prototype of this miniature, a Ford Model T Torpedo roadster, was a snappy number when it bounced over the roads of those days. Built by Arthur Salmons, of Hynes, Calif., the model has a dummy engine.



No Housing Shortage Here. A young Cocker spaniel poses in the doorway of a modern doghouse designed and built by Reginald Odegaard, of Burbank, Calif. Windows are heavy, shatterproof glass. The stonework consists of small flagstone chips laid individually in cement. Redwood siding makes up the remainder of the kennel.

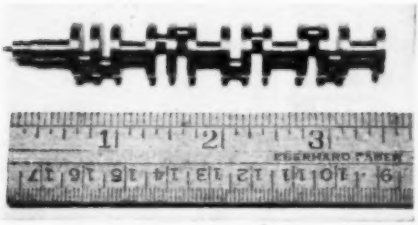


Builds Lathe to Build Motor. M. F. Shea, a retired telephone maintenance man of Drexel Hill, Pa., first built a watchmaker's lathe and then used it to turn all the screws for this three-pole motor. The thumbnail-sized midget whizzes on 3 volts. Commutator segments are German silver, brushes real silver.



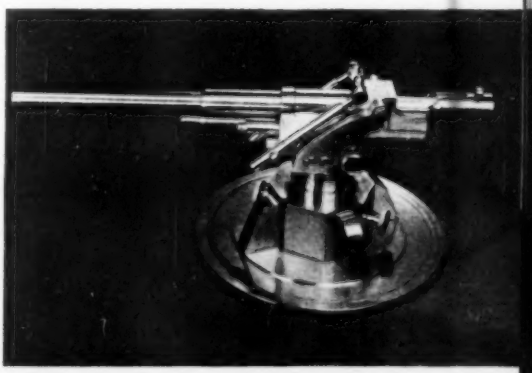
Boat Built from PS Plans. This 17′ cabin cruiser was built by C. A. Sherwood, a dental technician of Moncton, N. B., Canada. Spruce planking was used on the hull and marine plywood for the cabin roof. A 6-hp. inboard engine powers the craft. About seven months of spare-time work went into building the cruiser.

Engine Displaces .05 cu. in. Designed as power plants for free-flight model planes, these little Diesels turn up 11,000 r.p.m. with a propeller and 20,000 r.p.m. if the prop is replaced by a small flywheel. Elmer Larsen, of Seattle, Wash., a Boeing Airplane Company machinist, builds them in his spare time and sells them for $10 each. They burn a mixture of methanol-alcohol and castor oil, the latter furnishing the lubrication. A teaspoonful of fuel runs the engine about a minute. With the exception of the glow plug, Larsen makes all the parts of the engines in his basement.

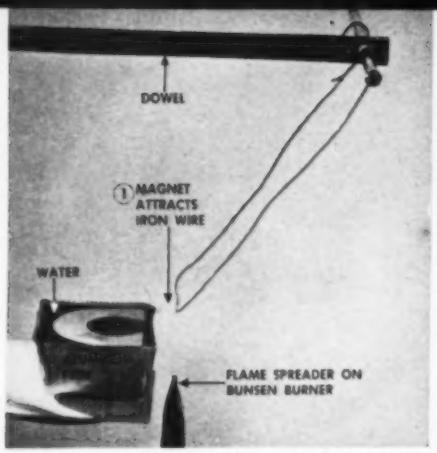


Crankshaft 3½″ Long. From a piece of steel ¼″ in diameter, Henry Juerin, of Elberon, N. J., turned this tiny crankshaft. It has five main bearings and is designed for an eight-in-line engine that Juerin built. The ruler shows how small it is.

Tractor for Kids. A 2/3-hp. engine powers this miniature tractor that S. C. Matula, of Boyceville, Wis., built for his youngsters. Since the tractor doesn't have any farm work to do, it's used principally to tow the coaster wagons of neighbors' children. It'll pull four wagons loaded with 12 kids.



Model AA Gun Fires Blanks. No castings were used in this model 75-mm. antiaircraft gun. James Marini, of Brooklyn, N. Y., used a lathe, shaper, and drill press to fashion the parts of steel. It fires .22-cal. blanks. The barrel measures 13″ and can be elevated 80°. When fully elevated, the gun measures 14″ high.



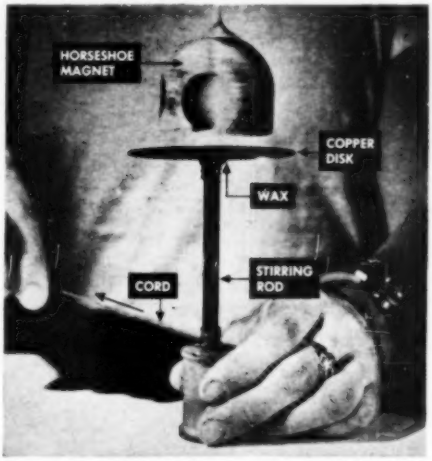
Iron loses magnetism if heated to 740° C., but regains it on cooling slightly. Simple magneto heat engine above makes use of this. The wire swings back and forth as it heats and cools.

Magnet Magic

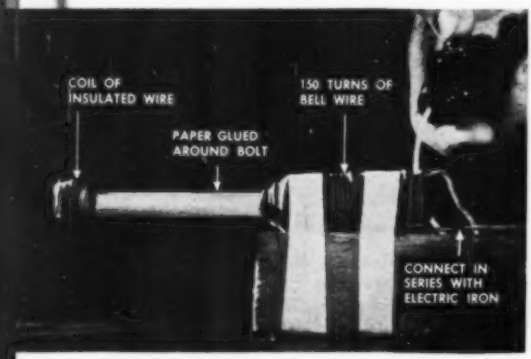
MAGNETIC materials sometimes act in unexpected ways. Extreme heat, for instance, robs iron of magnetic response, as you can see above. Submerge the magnet in water to prevent overheating.

Copper isn't usually considered magnetic, but glance to the right. Here, the spinning disk acts as a sort of electric generator. Eddy currents set up in it produce a corresponding magnetic field that drags the magnet around with the disk.

In setting up the "gun" below, anneal the bolt before winding. Join together the ends of the coil projectile. AC passing through the gun winding sets up a magnetic field in the bolt, and this in turn creates a field in the projectile. Since like poles face each other, the coil is thrown off the bolt.

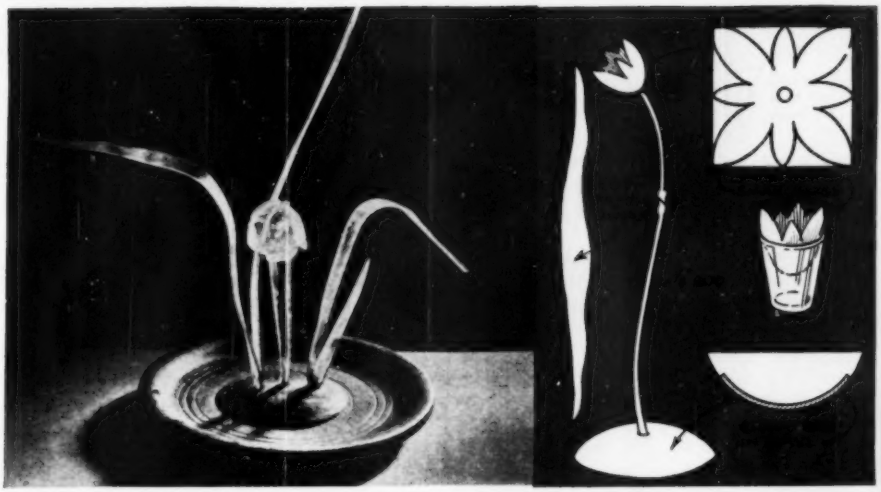


Electric currents set up in copper disk cause horseshoe magnet to turn same way as disk.



Magnetic gun "fires" coil projectile by repulsion. Coil consists of 75 turns of No. 24 insulated wire. It slips freely over bolt barrel. Switch on current and coil flies off as above.

Nail is magnetized temporarily even though it doesn't touch magnet. This is called magnetization by induction. Move the nail slowly away and tacks will fall off as it loses magnetism.

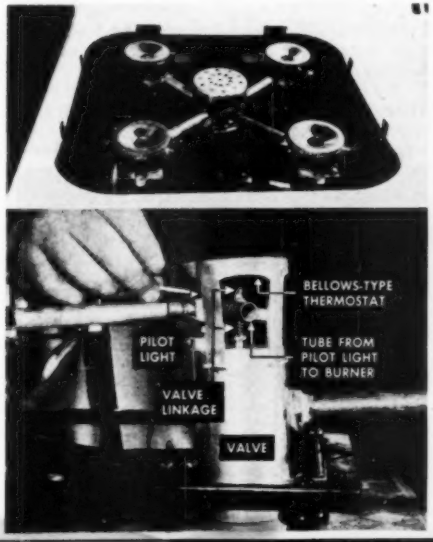


Plastic Flowers Won't Wilt

THE floral group pictured above was cut and bent from scraps of Lucite®. The stem is a section of ⅛″ rod and the leaves are random cuts of 1/16″ stock. Follow the pattern for the flower, cutting it from the same stock as the leaves. Then heat it, lay it over the top of a small glass, and push the center down. The base is a disk, heated and formed in a shallow bowl. Cement all parts together.—*P. E. Hart, Manhattan, N. Y.*

Gas Shut Off Automatically

ALL gas used in this stove, including that for the oven and pilot light, passes through a central valve. This valve is controlled by a bellows-type thermostat just below the pilot light. As long as the pilot light burns, the master valve remains open. If the pilot is accidentally blown out, or if gas pressure temporarily fails, the thermostat shuts off gas to all burners. A match is held under the thermostat to relight the pilot. The inventors are Lewis R. Kinsey and Henry F. Klein, both of New York City.



Rubber Cushions Plane Lift

THEY'RE called light planes but they can get to be heavy when you have to lift the tail around. This is especially noticeable if you have to move the ship any distance, since the metal lift will cut into your hand. I padded the one on my plane with garden hose. After slitting a short piece of hose, I coated the inside of it with gasket shellac. A good glue would do just as well. Then I slipped it on the lift and finished the job with a couple of wrappings of friction tape. —*Stewart Rouse, Knightstown, Ind.*

Concrete Mixer Cooks a Meal Too

FROM mixing concrete to cooking a meal isn't so far fetched when you consider what else this versatile machine does. It'll also sift fertilizers, soils, or aggregates, and spray paint or insecticide.

The 90-lb. Whirl Barrow® is a multipurpose unit designed for yard and farm work. Slip a screening attachment into the barrel and it becomes a sifter. Another attachment is a ⅓-hp. motor and a pump, enabling you to spray paint or to cover trees and shrubs with chemical solutions. Then there's the cooking. A grated pan for coals and a spit can be fitted in place. A screen rack may be laid over the coals to keep food warm and meats can be roasted on the spit.

By pressing the U-shaped stirrup with your foot, the bowl can be tilted to any of five positions. When pressure on the stirrup is released, a spring-loaded pin locks the barrel in position. For stability in rolling the barrow and for accuracy in pouring, the barrel is locked to prevent rotation by pressing a lever in the base. Twenty-five gallons of liquid or 1½ cu. ft. of concrete may be mixed. The mixer is made by Magna Engineering Corp., San Francisco.

Rotating offset handle turns bowl on a ball-bearing shaft that extends from the base. No other support is required.

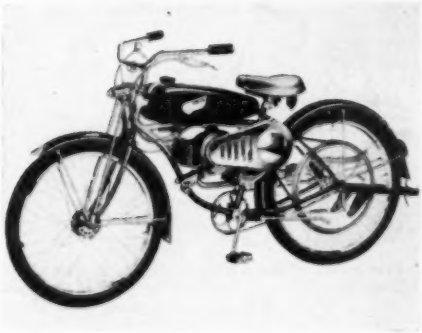
Frame is lightweight welded tubing. Large tire permits easy rolling over soft or rough ground. Bowl holds 1½ cu. ft. of concrete.

Whirl Barrow® also sifts soil, fertilizer, and other materials. Circular screen first is inserted in mixing bowl and handle turned.

Now it's a sprayer. A ⅓-hp. motor drives pump that raises insecticide or paint from the tank. Metal cover fits snugly over rim of bowl.

When day's work is done, mixer quickly becomes a charcoal broiler. Spit also may be slipped into place and used to roast meats.

Twin-Cylinder, 2-Cycle Engine Drives Bike



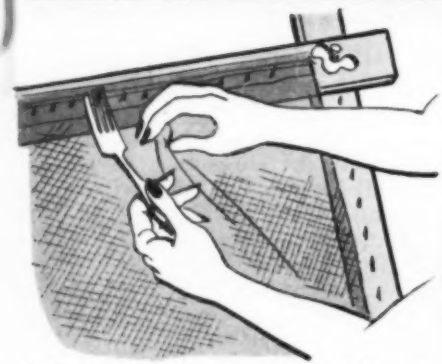
PLENTY of power on hills plus economical operation are two of the features claimed for this twin-cylinder bike engine by the makers, Jack & Heintz Precision Industries, Inc., of Cleveland, Ohio. The unit includes an auto-type, multiple dry-disk clutch, twist-grip controls, and a large combination fuel tank and utility compartment. Deep finning permits the engine to idle safely without overheating. Center-flow carburetion assures a steady flow of fuel even when the engine is tilted. A compression release contributes to starting ease and rapid deceleration. The unit comes complete, ready for installation.

Keeping the Home Shipshape

Store bath toys in net bags, the kind citrus fruits come in. The bags can be hung up out of the way and the toys will dry quicker because air can circulate around them.

Needles may be stored in a lipstick case. Stick the needles in a cork that has been pressed into the case. Turning the bottom lowers the needles so the cap may be put on.

Valuable papers that must be held temporarily in the home while awaiting transfer to a safe-deposit box may be stored in the refrigerator. It affords some fire protection.

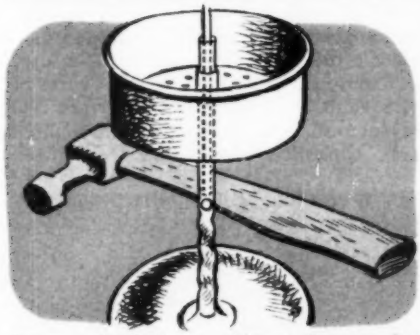


When mounting curtains on a stretcher, you won't risk pricking your fingers if you use a fork to press each section of curtain into place on the pins of the frame.

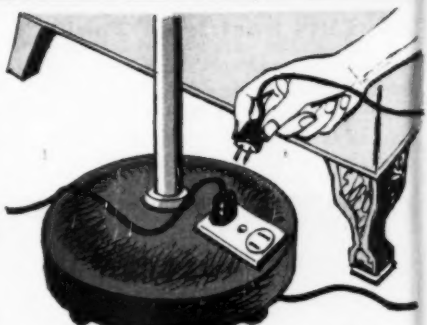
For a sickroom table, cut holes in the top of a small cardboard box and sit bottles of medicine in them. It'll prevent bottles from being upset and will keep the table neater.

Wrapped individually in aluminum foil and cooked in a bed of coals, wieners retain their juice and remain perfectly clean. Skins are not pierced as on a stick or fork.

To keep dust out of closets, tack felt weatherstripping to the sill or inside the bottom of the door. If tacked to the door, be sure the stripping touches the floor.

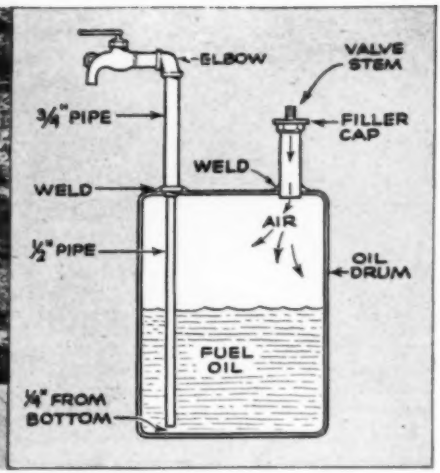


Bent or kinked percolator tubes can be straightened by inserting a tight-fitting bearing ball and forcing it through with a dowel. Tap the end of the dowel lightly.



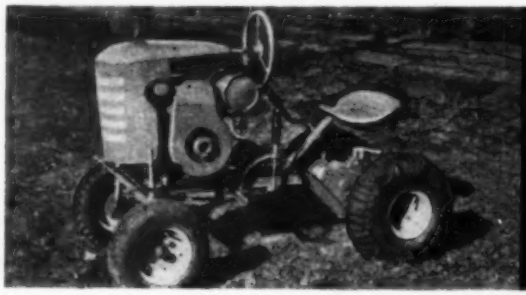
You can add to the usefulness of table and floor lamps by mounting an outlet on them so other appliances may be connected. The outlet may be set in if the base is of wood.

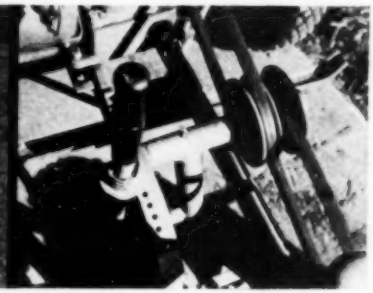
When moving, pack small amounts of staples in a separate box. In your new location, you'll have supplies for the first few meals in the small box without unpacking large containers.



Air Lifts Fuel from Tank

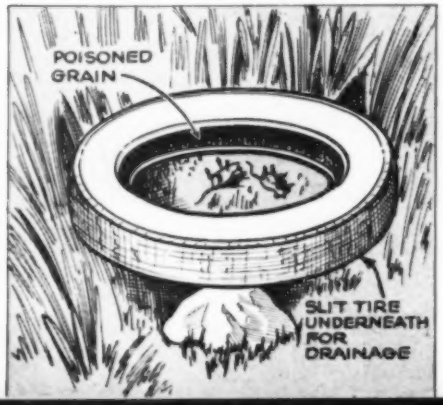
An underground storage tank, operated by air, can be made from a seamless, galvanized oil drum. Use one of 50- to 200-gal. capacity, with both openings at one end. Replace the filler cap with a pipe 6" longer than the depth the drum will be buried. Other connections are shown in the sketch. Solder a tire valve stem into the filler cap, but remove the valve core. A few strokes of a tire pump forces liquid out of the tank. To prevent rust, coat the tank with asphaltum paint.—*Clinton R. Hull, Costa Mesa, Calif.*





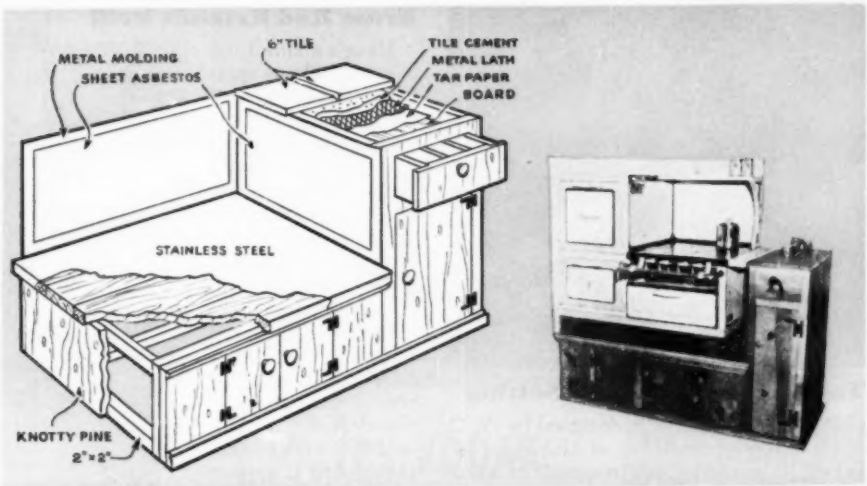
Scooter Parts Make Tractor

Pictured above is a small garden tractor that I built from parts of an old motor scooter and other pieces of scrap metal. It will pull an 8" plow in heavy soil and does a lot of other odd jobs. The variable-speed V-belt transmission, shown in the photo at right, can be shifted while the tractor's in motion. The final drive is through a 24-to-1 transmission that I bought at a war-surplus sale.—*Clyde Clymer, Lincoln, Nebr.*



Old Tire Holds Pest Poison

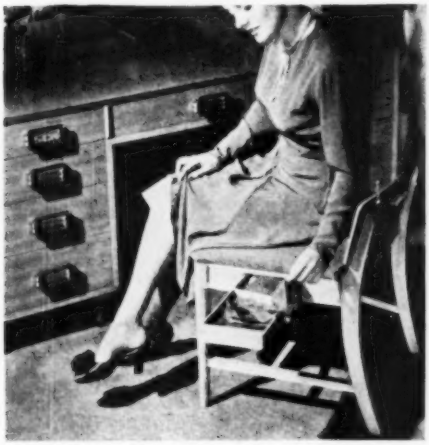
Poisoned grain may be safely set out in old auto tires. Pets and birds can't get to the grain, yet field mice can. Slit the side of the tire that'll be next to the ground so any rain water may drain out. Spread the grain around inside the casing and raise one side with a small rock to give mice an entrance.—*John Krill, North Lima, Ohio.*



Cabinet Utilizes Waste Space Under Old Range

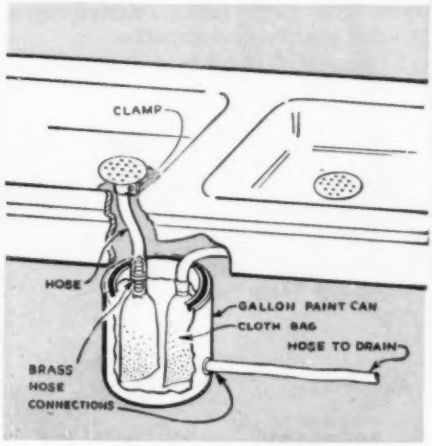
THE cat won't like it, but here's a way to make better use of the space below one of those old stilt-type kitchen ranges.

Cut off the legs and set the range on a neat cabinet like the one above, which was made of knotty pine on a 2" by 2" frame. There's plenty of space below for pots and pans, while long-handled utensils can be hung in the tall cabinet. Cutlery goes in the drawer at top.—*Hi Sibley, Nuevo, Calif.*



Vanity Chair Has Own Drawer

A THREE-SECTION sliding compartment in the vanity chair above provides storage space for hose or handkerchiefs. The chair and vanity in the background are part of a new line of Monogram® furniture offered by the Mengel Company, of Louisville, Ky. The drawer pulls are designed so that your initials, in gold, can be slipped in.

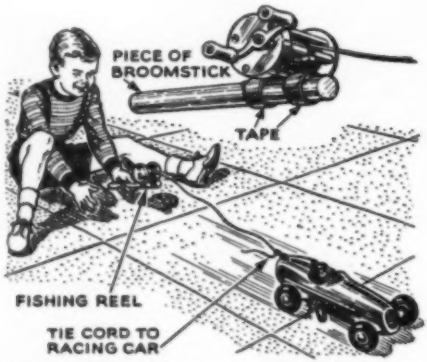


Trap Keeps Sink Drain Clear

IN USE for a year on my house trailer, the improvised drain trap above has worked like a charm. Two brass hose connectors were soldered to holes in the can lid and a third in the side. Cleaned regularly by prying off the can lid and putting on new cloth bags, the trap keeps the drain from clogging.—*F. H. Louden, Bellflower, Calif.*

Tool Speeds Tappet Setting

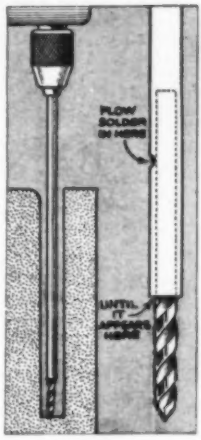
THIS combination tool, designed by W. C. Herst, a master mechanic of Dubuque, Ia., is said to halve the time required to adjust auto-engine tappets. As shown in the photo, the tool holds the tappet body and the lock nut. The lower leg of the tool has a feeler gauge held to it by metal straps so the gauge may be pushed forward. With one wrench holding and with the feeler gauge in place, the other wrench is used to adjust the tappet. Once set on a tappet, the tool will remain there. Engine vibration can't shake it off. In the photo, a dummy tappet is being used for demonstration.



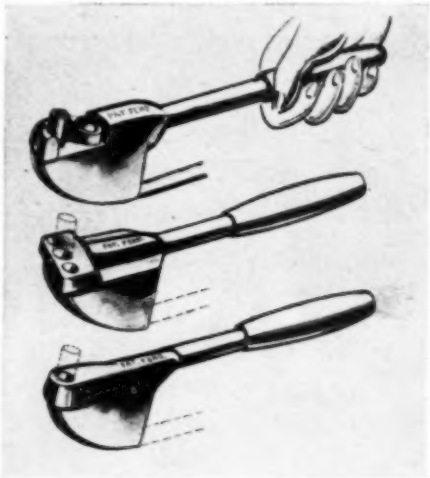
Old Reel Retrieves Toy Auto

AN OLD fishing reel, taped to a section of broomstick, is a quick retriever for rolling wind-up toys. After the toy has run its distance, the child can reel it in. If you don't have an old reel, some surplus-property stores sell the small, low-priced reels that were included in survival kits during the war.—*Walter B. Weber, Angola, N. Y.*

Brass Rod Extends Drill

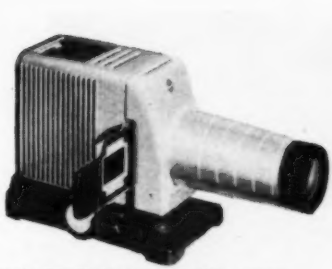


HERE's a kink I use to get a drill into spots where there's no room for the chuck. As an example, say a No. 50 hole has to be drilled in a valley about 5″ deep, as shown in the sketch. In one end of a 6″ length of brass rod, drill a No. 50 hole deep enough to take about three-fourths of the drill. File a notch ½″ from the end of the rod. Put the shank of the drill in the hole and flow solder in the notch until it appears at the end of the rod. You can save these extensions until you have a set, or you can remove the drills by heating the rod until the drill can be pulled out. Fine sandpaper will clean bits of solder off the shank of the drill. —*Herbert Pfister, Bronx, N. Y.*

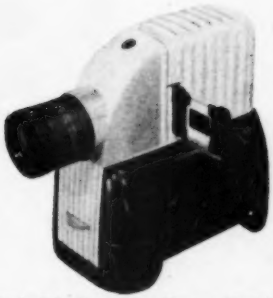


Tools Bend Small Tubing

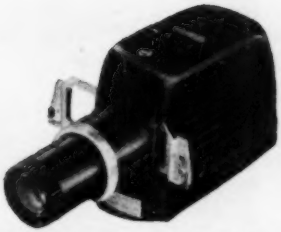
KNOWN as Bob's Tu-Benders®, these three tools handle bending jobs on tubing from ⅜″ to ⅞″ o.d. They're priced from $2.50 to $4.50, depending on the type, by the distributor, Keiner Machine Products, of Los Angeles. According to the company, the tools can quickly be slipped on or off tubing and there is no chance of kinking.



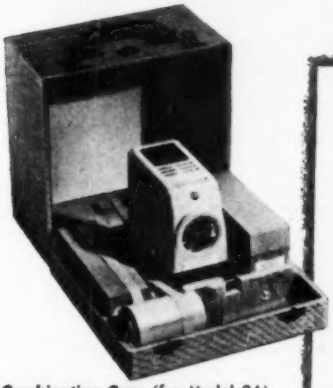
Kodaslide Projector, Model 2A—Lumenized Kodak Ektanon 5-inch f/3.5 Lens. Adjustable tilt control. $47.50.



Kodaslide Projector, Master Model—1000-watt lamp. Superb optical system. $181 to $295, depending on lens choice.



Kodaslide Projector, Model 1A—Projects bright images up to 7 feet wide. Efficient, yet inexpensive. $27.50.



Combination Case (for Model 2A)—Holds Kodaslide Projector, Kodaslide Changer, lens, Kodaslide Sequence Files or Kodaslide File Boxes. $15.

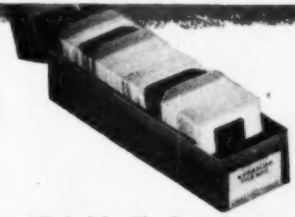
IT'S KODAK FOR BRILLIANT COLOR SHOWS

. . . everything you need for miniature-slide projection

Projecto Case (for Model 1A)—For carrying, storage, and projection. $10.

Kodaslide Table Viewer—Screen, projector, and slide changer all in one unit. $95.

Kodaslide Dissolve Control Outfit—For "fade-in-fade-out" effects with Kodaslide Projectors, Models 1, 2, 2A. $50.



Kodaslide File Box—Protects 140 cardboard slides, 55 glass slides, keeps them organized. $1.15.

Kodaslide Compartment File—Slide compartments swing out. Holds 240 cardboard slides. $3.75.

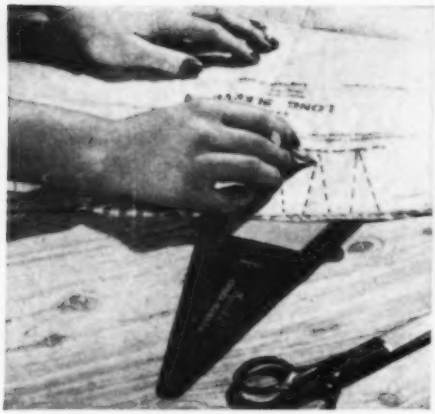
Kodaslide Changer—Simplifies changing slides. Gives a smooth show. $17.50.

Kodak Slide Kit—Glass, masks, and binding tape for 50 slides. $2.90.

Your Kodak dealer has everything you need for color shows—visit him today.

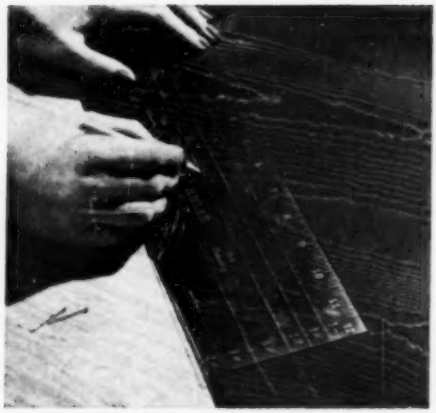
EASTMAN KODAK COMPANY, ROCHESTER 4, NEW YORK

Kodak



Device Doubles Pattern Guides

To PUT dressmaker's marks on two pieces of cloth at a time, just slip this new plastic device under the second layer. When you mark with a pencil through the regular pattern perforations onto the top layer of cloth, the bottom layer is pressed against a coated transfer sheet, contained in the device, and is marked by it. Sewing Products Co., of Cincinnati, Ohio., makes the marker.



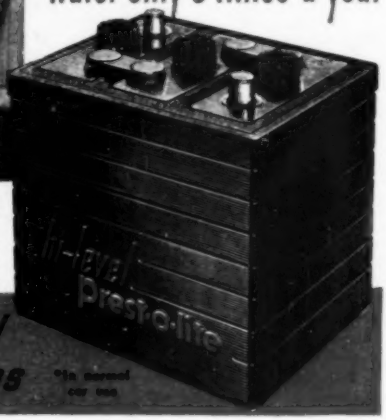
Ruler Simplifies Sewing

YOU can mark guide lines on fabric right through this new ruler, made of transparent, rigid, Vinylite® plastic. It has parallel slits at varying intervals, giving different widths for cutting bias strips, belts, and buttonholes. Manufactured by Sewing Products Co., of Cincinnati, O., the ruler is available at department and notion stores, and sewing centers. It costs $1.00.

BUY

Prest-o-lite

hi-level batteries... need water only 3 times a year*



Avoid battery troubles—buy a Prest-O-Lite Hi-Level Battery. Gives up to 70% longer average life as shown in tests conducted in accordance with S.A.E. life cycle standards. See your Prest-O-Lite Hi-Level dealer today.

Toledo 1 PREST-O-LITE BATTERY COMPANY, INC. Ohio

Prest-o-lite hi-level batteries

*In normal use

Before anti-freeze goes in clean out rust and scum

Rust-clogged radiators waste anti-freeze ... cause trouble and expense

Clean out rust with

DU PONT COOLING SYSTEM CLEANSER

Don't put anti-freeze into a rust-clogged radiator. Clean out the rust, scale and scum *now* before winter sets in. Just pour a can of DU PONT CLEANSER into your radiator, run the engine for 30 minutes or more, then drain. That's all! It cleans thoroughly without reverse flushing. It's safe, sure, and easy to use.

Keep out rust with

DU PONT ACID AND RUST INHIBITOR

After cleaning out the radiator, you can keep it free from rust all season by pouring in a can of DU PONT ACID AND RUST INHIBITOR. It retards rust formation, and keeps out acid, too.

Avoid leaks and loss of anti-freeze

DU PONT COOLING SYSTEM SEALER

You can stop leaks quickly and securely—and help to prevent radiator leaks in the future—by pouring in DU PONT COOLING SYSTEM SEALER. It will not clog the radiator or harm hose or metal parts.

DU PONT

REG. U. S. PAT. OFF.

Better Things for Better Living ... Through Chemistry

PLUMB TOOLS

Do Better Jobs With Ease and Speed

Get a Plumb Hammer. You'll feel the difference immediately. The non-slip handle fits your hand comfortably, absorbs the shocks. Perfect balance lets you strike quick, hard blows with ease and little effort—makes light work of your heavy jobs.

Made of special analysis steel, Plumb hammers are tempered to withstand constant, heavy pounding. For pulling nails, even headless ones don't slip through the spring-tempered claws.

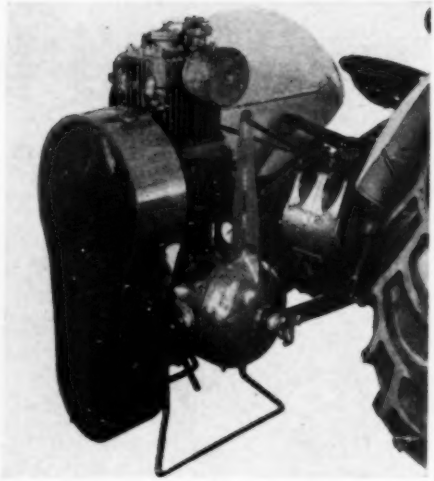
You'll discover quickly why more people choose Plumb than all others combined.

The red handle with the black head — exclusively Plumb.

Quality Comes First
PLUMB
—is First in Quality

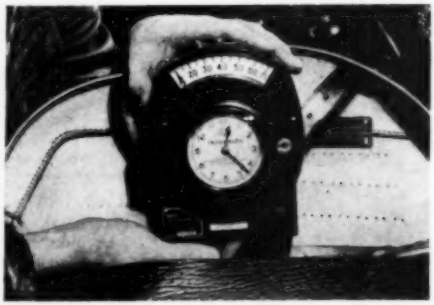
PLUMB

HAMMERS • HATCHETS • AXES • FILES



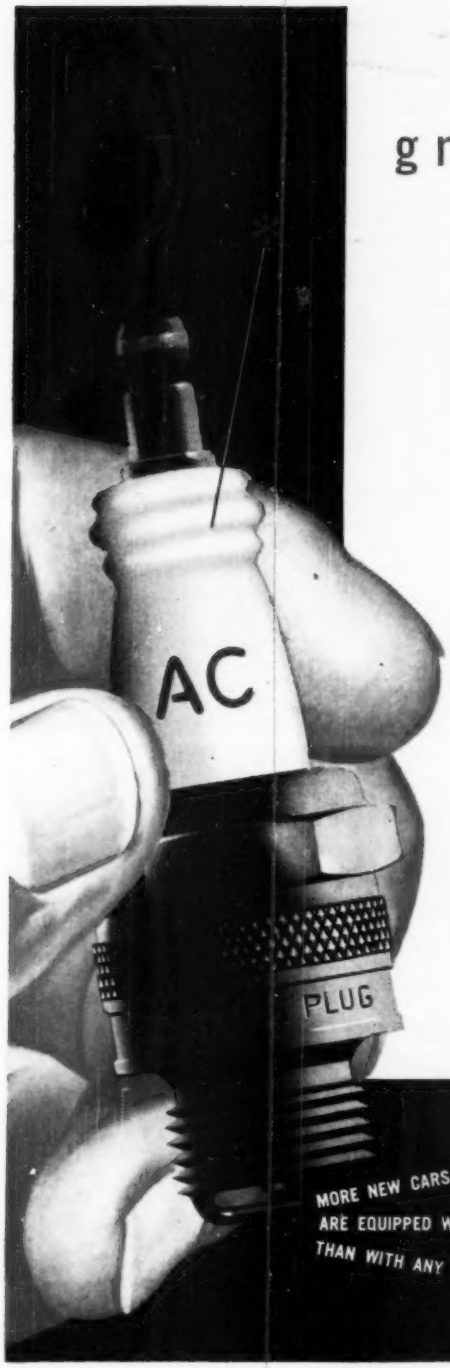
Tractor Runs Compressor

JUST hitch this portable air compressor to the power take-off of a tractor or a jeep, and you'll get the compressed air you need at a working site without bringing in a heavy machine requiring its own engine. Used to run air-operated equipment, such as lifts, hoes, and shovels, or for painting and spraying, the easily attached compressor comes in two sizes. It is made by Miller-Robinson Co., of Los Angeles.



Device Records Cycle Test

A HELPING hand for motorcycle test riders, this tachograph automatically records the speed, time, and distance a vehicle travels. Thus it lets the rider pay more attention to the motorcycle's actual performance. Test conditions are continuously recorded as wavy red lines on an enclosed chart. An engineer of Harley-Davidson Motor Co. used this method of experimenting with a motorcycle in recent tests.



grand slam...

● Grand slam in performance.

Because of AC's patented CORALOX Insulator,* AC Spark Plugs perform better than spark plugs ever did before.

They start better . . . idle better . . . fire better under all conditions.

They offer more resistance to oxide coating.

They give you a grand slam in spark plug performance.

That's a big order . . . but it's true. A set will prove it.

AC SPARK PLUG DIVISION • GENERAL MOTORS CORPORATION

AC

SPARK PLUGS

BUY WHERE YOU AC SERVICE SEE THIS SIGN

MORE NEW CARS AND TRUCKS ARE EQUIPPED WITH AC SPARK PLUGS THAN WITH ANY OTHER MAKE

*AC's patented processes make Coralox the finest insulator in spark plug history. Improved electrical insulation; no matter how high the temperature. Better heat conduction. Maximum resistance to heat shock. Less fouling. Stronger, longer-lived.

Cutouts Dramatize Records

MEMBERS of the bedtime-story set can now act out such favorites as "Goldilocks" and "The Three Little Pigs" as they hear them on records. Each dramatization, on 12-in., durable Vinylite® records, is accompanied by colored cardboard cutouts of the characters and stage props. Made by Family Games, San Francisco, they sell for $2.95.

Music Soothes Commuters

THE circular fixtures on the ceiling of this trackless trolley in Cincinnati are radio loudspeakers. Eight of them in each trolley are connected with an FM set under one of the seats. The system was installed free by Transit Radio, Inc., as an extra outlet for regular programs sold to advertisers. It carries no soap operas or singing commercials.

choose your

ANTI-FREEZE

now!

EXTRA STRENGTH gives the most protection at the lowest cost.

NO disagreeable odor.

LONG LASTING! Safe, sure protection with only an occasional check-up.

PREVENTS CORROSION of all cooling system metals!

WILL NOT BOIL AWAY! Guaranteed protection for a full winter driving season.

NON-CORROSIVE! PEAK is fully inhibited to prevent cooling system corrosion.

WILL NOT LEAK from any cooling system tight enough to hold water.

HARMLESS if spilled! Will not injure automobile finish.

NOR'WAY® PEAK®

PRODUCTS OF COMMERCIAL SOLVENTS CORPORATION

OIL-PUMPING is a symptom of piston ring wear. And by the time you notice it, your rings will be pretty badly worn. They should be replaced immediately.

Hastings Piston Rings are designed especially for replacement service . . . So ask for Hastings—the replacement ring that *stops* oil-pumping, *checks* cylinder wear and *restores* performance. It's the best money you can spend on your car.

HASTINGS MANUFACTURING COMPANY
HASTINGS, MICHIGAN
Hastings Ltd., Toronto

HASTINGS

STEEL-VENT PISTON RINGS

"TOUGH . . . BUT OH SO GENTLE"

TOUGH on oil-pumping—GENTLE on cylinder walls

Standard for Home and Industry

SINCE 1899

Kester Flux-Core Solder — the home and hobbycraft worker's choice for fast, reliable soldering . . . Kester Metal Mender and Kester Acid-Core Solder for general work . . . Kester Radio Solder and Kester Plastic Rosin-Core Solder for radio and electrical work.

Kester Solder makes all metal repair jobs easier

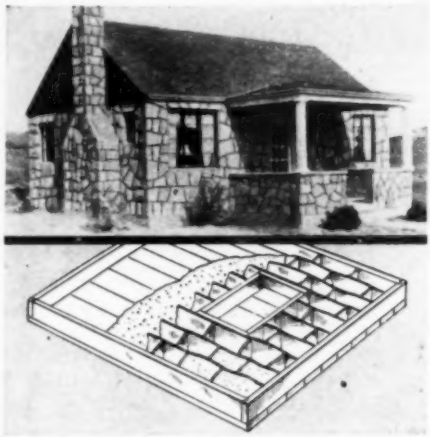
1899 50th Anniversary 1949

KESTER SOLDER

KESTER SOLDER COMPANY
4201 Wrightwood Avenue, Chicago 39, Ill.
Factories also at
Newark, New Jersey • Brantford, Canada

Magnetic Roller Sweeps Metal

PICKING up stray bits of metal from floors and roads or out of liquids and powders is simple with this sweeperlike magnetic roller. Called the Magnetool®, it has 50 percent more pick-up power than previous models. The inset shows how particles are removed by a wiper ring that pushes them to a non-magnetic spot where they fall off.



Cement Blocks Look Like Stone

Now you can make concrete building blocks that look like natural cut stone. They are cast in irregular shapes that fit together. Partitioned wall forms are first laid out with spaces for doors and windows (lower picture). Then concrete is poured in and covered with crushed Imistone®. When hard, the blocks are cemented together.

What's NEW in Batteries?

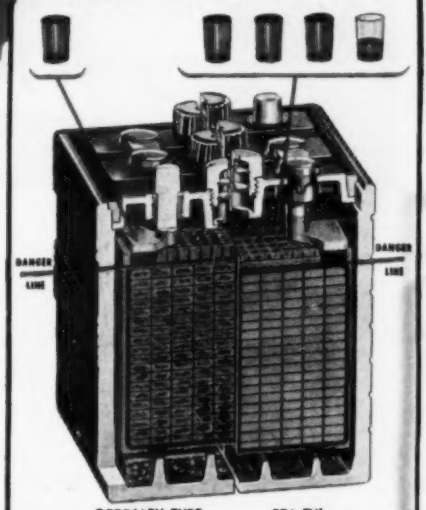
AUTO-LITE Sta-ful BATTERY...*needs water only 3 times a year**

A revolutionary new development, the Auto-Lite "Sta-ful" Battery, protects you against a major cause of battery failure .... damage to plates due to liquid loss. This new "Sta-ful" Battery design permits a liquid reservoir with 3 times the capacity of ordinary batteries . . . keeps plates fully covered and active months longer in normal car use.

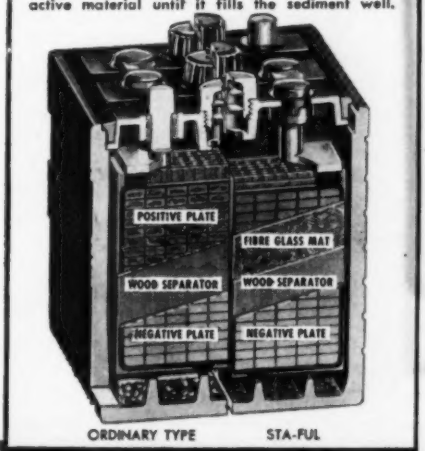
In addition, "Sta-ful" has Fibre-glass mats to hold the power-producing material in the plates for longer battery life. To get more for your battery dollars, replace with an Auto-Lite "Sta-ful". Money cannot buy a better battery.

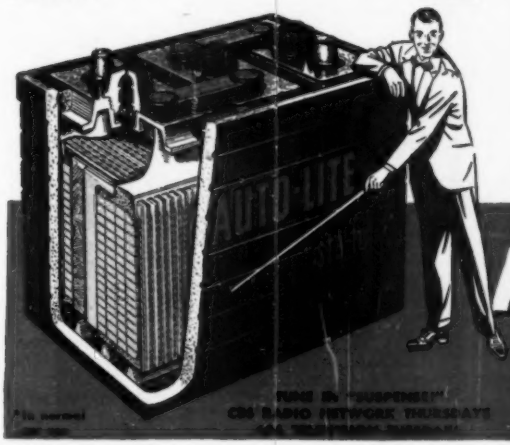
AUTO-LITE BATTERY CORPORATION
Toledo 1 Ohio

Because of a unique construction, the new Auto-Lite "Sta-ful" Battery holds more than 3 times the liquid reserve of ordinary batteries.



Note how the protective Fibre-glass mat retains the power-producing material in the positive plate while ordinary battery plates shed the active material until it fills the sediment well.





AUTO-LITE Sta-ful BATTERIES

*In normal use

TUNE IN "SUSPENSE"
CBS RADIO NETWORK THURSDAYS

Free...

NEW POWER TOOL AND WELDING EQUIPMENT BOOK

Beautiful rotogravure 52-page book contains hundreds of illustrations, descriptions and specifications of Wards well-known Powr-Kraft line of tools for wood and metal, and motors. Also shows the nationally-known Logan Metal Lathes, Mall Electric Saws, Burke Milling Machines, Burgess Hand Tool Kits, deluxe quality Beaver Power Tools, etc. Book features the popular Shopsmith, a complete 5-tool-in-1 workshop. All tools may be purchased on convenient monthly payments at Wards Mail Order Houses, Catalog Order Offices or Retail stores.

Every power tool beginner, advanced hobbyist and production shop should have a copy of this money-saving catalog. Use coupon for your free copy now!

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MONTGOMERY WARD, Dept. 84PS-10
Please send me free Power Tool and Welding Catalog.

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Route, Box_____

Post Office_____ State_____

Phone_____

Lantern Has One Control

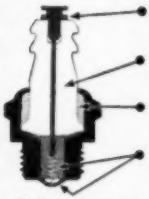
THERE's only one control handle to adjust when lighting the new Ready-Lite® gasoline lantern above. The knob combines starting air mix, cleaning needle, and gas-line valve and is shaped so it can be set at the right point by feel in the dark. Thanks to a burner plate that deflects heat in a sideways direction instead of up, the lantern is cool to carry. A combination pump and filler plug provides a ¾-inch fuel opening for the lamp, which is manufactured by American Gas Machine Co., of Albert Lea, Minn.

Sundial Time

SUN time, as shown on the sundial, starts getting earlier after December 22. In November the sundial is more than 15 min. ahead of our clocks, while in mid-February it is nearly 15-min. slow. In January the difference between sun time and clock time is rapidly changing—which makes the sun seem to rise earlier.

CHAMPION V-GLOW PLUGS

for model engines only



- **CHAMPION TERMINAL**—assures better center electrode seal and provides sturdier electrical connection.
- **CHAMPION-CERAMIC INSULATORS**—proved dependable in millions of Champion Spark Plugs.
- **CHAMPION SILLMENT SEAL**—prevents excessive compression leakage between insulator and shell.
- **CHAMPION "THERM-O-FLEX" CONSTRUCTION**—longer element life, more dependable performance.

Follow recommendations of plug types and fuels approved by engine manufacturer.

CHAMPION SPARK PLUG COMPANY, TOLEDO 1, O.

DEPENDABLE

CHAMPION

SPARK PLUGS

America's Favorite →

FOLLOW THE EXPERTS
use the spark plugs champions use

These first crisp days of the football season should remind you that hard starting weather is just ahead, and to have your Champion dealer check your spark plugs. There's nothing like a new set of dependable Champion Spark Plugs to revitalize a sluggish and gas wasting engine. Perhaps they'll only need cleaning and adjusting—but if you find you need new ones, be sure you get Champion, America's Favorite Spark Plug for over a quarter century.

CHAMPION SPARK PLUG COMPANY, TOLEDO 1, OHIO.

Listen to the CHAMPION ROLL CALL . . . Harry Wismer's fast sportscast every Friday night, over the ABC network

New Values
ZEPHYR MODELS
Portable Electric Tools

Factory Guarantee
Light Weight
Easy Handling
Compact

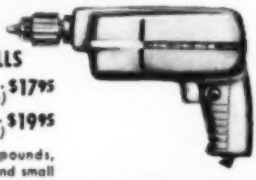
Long Life
Low Price
Latest Design

ZEPHYR SERIES 500
½-INCH ELECTRIC DRILLS

Model No. 500 (with Jacobs Hex Chuck) $29.65
Model No. 510 (with Jacobs Gear Chuck) $34.65

Full ½-inch drill capacity; removable side handle for close-quarter drilling; weight complete only 9 pounds. U. L. listed.

ZEPHYR SERIES 1950
¼-INCH ELECTRIC DRILLS



Model No. 1950-H (with Jacobs Hand-Tite Chuck) $17.95
Model No. 1950-G (with Jacobs Gear Chuck) $19.95

Weight complete, only 3 pounds, 2 ounces. The speed, power, and small size make it the ideal power tool; handy to use as source of power for driving drill attachments for disc sanding and polishing, cleaning paint brushes, grinding and sharpening tools, buffing, removing rust and paint with wire wheel brushes, etc. A real money saver around the house, farm and home shop. U. L. listed.

SPRAYMASTER
ZEPHYR
MODEL SM-25
$24.95

A complete electric sprayer unit with electric motor, two-cylinder air compressor, pressure equalizer storage tank, 25 to 30 pounds pressure. Sprays paint, enamel, lacquer, insecticides, and mothproofing solutions. Easy to use—no spraying experience necessary for fine job on furniture, cars, radiators, etc. Full instructions with every unit.

See these tools at your dealer, or write direct for full information. Dealer inquiries invited.

GET THIS FREE BOOKLET—16 pages of detail information on Portable's complete line of top-value electric tools, tool kits, and work-saving attachments.

PET PORTABLE ELECTRIC TOOLS, Inc.
326 W. 83rd St., Chicago 20, Ill.

Units Increase Box Depth

You can have either deep or shallow boxes for holding factory materials on skids with the bottomless, hardwood units above. Unit "A," with flanged metal corners that extend beyond both its ends, fits snugly over a skid, which serves as the bottom of a container. Piling Unit "Bs," which are flanged on one end only, on top of an "A" increases a box's depth. Ironbound Box & Lumber Co., of Hillside, N. J., is maker.

"Mike" Gauges Glass Tubes

THE thickness of a glass tube—or any curved, closed, transparent material—can be measured with Opti-Mike® above. Thickness is found by placing the surface to be measured against a measuring head. Then a graduated dial is twisted until a lamp image is seen sharply focused through the eyepiece. Developed by Instrument Development Laboratories, the device measures to an accuracy of .001 of an inch.

AMAZING NEW LOW-PRICED ELECTRIC SPRAYER

makes painting **EASY!**

Pat. Applied For

the original
BURGESS vibro-sprayer

NO MOTOR... NO COMPRESSOR... NO "EXTRAS" TO BUY

Sensational Low Price
$12.95
Complete

Just Plug In and Spray!

Easy, economical paint spraying is now as convenient as your nearest electrical outlet. Just plug the sensational Burgess Vibro-Sprayer into any 110 volt A.C. socket, press the trigger and spray. You get a beautiful, smooth finish on tables, chairs, bookcases, toys, fences, screens, floors...almost anything around the home or shop... in minutes instead of hours. Refinishes car bodies and fenders, too. And Vibro-Sprayer handles enamel, lacquer, varnish, shellac...plus light oils, insecticides. Weighs only 2½ lbs. Comes complete with 25 oz. Mason-type jar and 8 ft. cord. Fully guaranteed.

Write for FREE Literature

Unique BURGESS vibro-tool

adds POWER to hand skills!

This revolutionary marking tool delivers 7200 vertical strokes per minute to write like a pencil on hardest steel, mark tools, decorate glass, engrave plastics, tool leather, chisel wood or linoleum blocks, emboss metal foil, cut balsa wood, cork and cardboard. Specially designed kits for general use, leather tooling, and simple marking and engraving. All-purpose Master Craft Kit with 9 attachments shown, only.....**$9.95**
Leather Craft Kit plus 9 attachments.....**$9.95**
Marking Kit including Vibro-Tool and hard tantalum carbide point....**$7.50**
3 different kits... each packed in sturdy, attractive storage case

BURGESS

BURGESS BATTERY COMPANY, Handicraft Division
165 RAND ROAD, LAKE ZURICH, ILLINOIS

Please send me full information on: ☐ Vibro-Sprayer, ☐ Master Craft Kit, ☐ Leather Craft Kit, ☐ Vibro-Tool and Point.

My Name_____

Street Address_____

City_____ Zone_____ State_____

BURGESS BATTERY COMPANY HANDICRAFT DIVISION LAKE ZURICH, ILLINOIS

Just dial ANY WIDTH CUT ON YOUR SAW

WITH

Warren

DADO SAWING WASHERS

Cut clean, accurate, parallel grooves—12 widths, any angle. No chatter, burning, chewing—or sanding! No more blade vibration—no screws to fuss with—just four balanced washers. Simply dial desired width with Micromatic adjustment. Can be left on blade for straight cuts. Available in 5 sizes—½", ¾", ⅝", 1", 1⅛". A perfect gift for woodworkers. See your dealer or write—

$4.95 SET

WARREN WASHERS CO.

Dept. 50 · 70 Medbury · Detroit 2, Mich.

BUILD YOUR OWN TILTING ARBOR SAW!

SAVE $50 OR MORE

Exclusive GIL-BILT Build-It-Yourself Features

- No machining—build easily with hand tools only
- No blueprint reading—step-by-step pictorial plans, full scale patterns, actual photographs
- Sturdy wood, aluminum, and steel construction
- Capacity and performance of commercial saws selling for $60 and up

GIL-BILT 10-INCH TILTING ARBOR SAW

- 27x28 in. table, 13½ in. capacity in front of blade
- 10 in. blade cuts 3¼ in. deep, tilts full 45 degrees
- Floor model 34" high table always stays level
- New Departure ball bearing arbor, ¾" precision shaft turned down for ⅜" bore blades, alum. housing, shipped ready to run
- Jackscrew and 4½ in. dia. handwheel lowers and raises blade
- Cast aluminum miter gauge and self-aligning rip fence guide

GIL-BILT Metal Parts Kit includes Plans, ball bearing arbor, miter gauge and bar, rip fence guide, dado insert, lock knobs, jack screw mechanism and handwheel, and all other metal parts (less blade) **$20.95**
Same Kit with 10" Combination Blade . **$24.90**
Same Kit with 8" Combination Blade . . **$23.90**

GIL-BILT 12-INCH BAND SAW

- Cuts to center of 24 inch circle
- Handles stock up to 6 inch thick
- 18x18 inch table tilts 45 degrees
- Lower wheel and drive pulley runs on sealed New Departure Ball Bearings; Upper wheel runs on two ⅜" bore Oilite Bronze bearings.
- Upper and lower blade guides. Each has ball thrust bearing, self-lub bronze jaws.
- Rubber tired wheels. Choice of cast aluminum or make-your-own wood wheels on metal hubs.
- Uses standard 78 inch blades up to ⅜ inch wide.
- Fully enclosed mechanism for utmost safety.

GIL-BILT Metal Parts Kit includes Plans, rubber tires, ¼ inch blade, hubs for wood wheels, ball bearing spindle, tilt mechanism, guides, table tilt segments and all other metal parts **$16.95**
Same Kit with two machined ready-to-install 12" cast aluminum wheels **$20.95**

Return in 10 days for full refund if not satisfied.
*(Prices include postage within 600 miles. Over 600 add 5%)

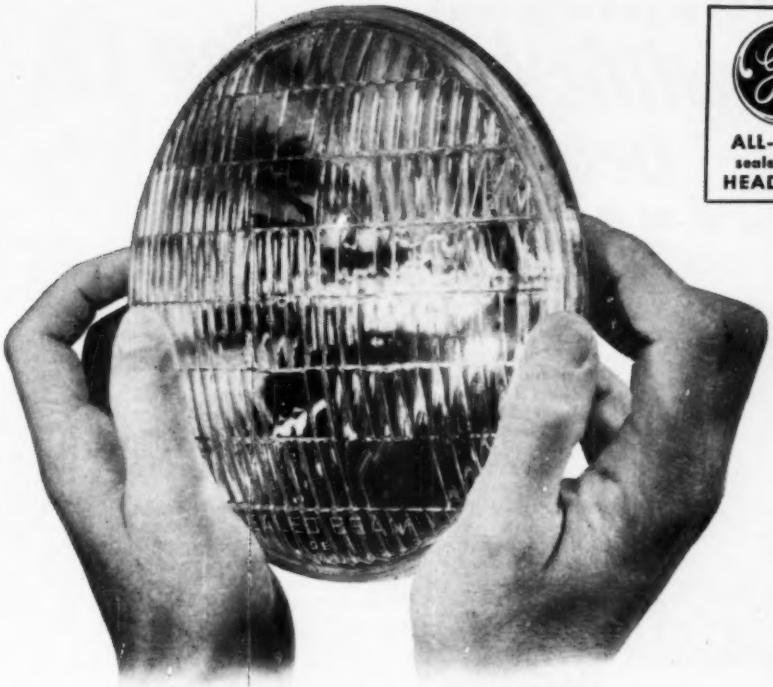
Also available—Plans and Parts Kit for 8" Tilt Table saw. Order Plans at $1.00 each—sent postpaid anywhere in the world or write for FREE descriptive catalog.

GILLIOM POWER TOOLS P. O. Box 1-VK, Lambert Field St. Louis 21, Missouri

Keep Brushes like New

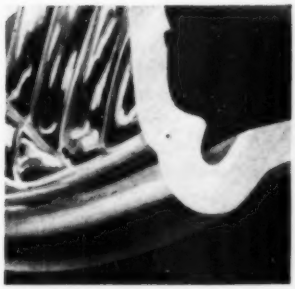
At Paint, Hardware, Dept., and 5 & 10c Stores

Patent Cereals Co. Geneva, N. Y.

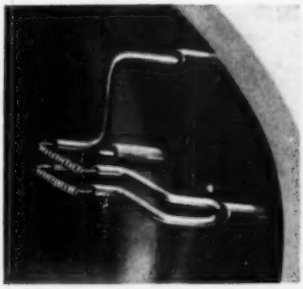


ALL-GLASS
sealed beam
HEADLAMPS

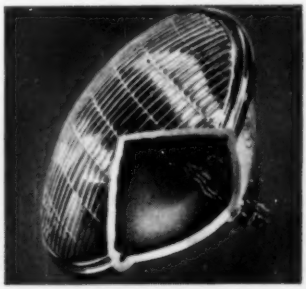
Why this headlamp does not grow dim



1. DIRT AND MOISTURE can't get in to steal the light, because the General Electric headlamp is a one-piece "all-glass" unit. Lens is shock-resistant hard glass, precision-made to throw maximum light on road.



2. RUGGED FILAMENTS give 12% more light on the road for driving, 16% more light for passing. Clamped in a vise-like grip, they won't shake loose. And the reflector stays mirror-bright for life.



3. ONE-PIECE CONSTRUCTION means G-E headlamps average 99% of original brightness at end of life . . . *do not grow dim!* Have lights checked when car is serviced. Get G-E lamps for replacement.

You can put your confidence in—

GENERAL ELECTRIC

FOR YOUR CAR'S ENGINE

Scientific Lubrication begins here

THE MARVEL INVERSE OILER ASSURES LUBRICANT PROTECTION FOR EVERY ENGINE PART

The upper cylinder area of your car's engine is the hottest, most critical spot in the operating motor. Here, ordinary lubricants fold up, causing rapid wear of pistons and cylinder walls. You can keep wear down and performance up with the MARVEL INVERSE OILER! Shown above is the operating head (without dust cap) of this famous, low cost device that meters MARVEL MYSTERY OIL to the engine, precisely in accordance with the demands of the engine under load. When used with MARVEL MYSTERY OIL, it's guaranteed for TWO YEARS!

MARVEL MYSTERY OIL is not just an oil but the famous Additive that produces a slow idle, faster engine pick up, easier starting and an even, power pull. Thousands of economy-minded car owners have used it enthusiastically for years. Learn what MARVEL can do for you to make your car do more and last longer.

WRITE FOR THE FACTS - NOW!

Easily Installed on All Engines

EMEROL MANUFACTURING CO., INC.
242 W. 69th ST., NEW YORK 23, N. Y.

ACCURACY!
CONVENIENCE!
BEAUTY!

Next time you're near your hardware or building supply dealer, try MASTER STREAMLINE. You'll know you're handling a superbly precise measuring instrument . . . *worthy of the professional man and the highly skilled craftsman!*

Note the extra-long 7/16" tip: STAYS PUT ALMOST ANYWHERE! . . . the positive Lever Tape Lock: HOLDS READING AUTOMATICALLY! . . . fine tempered steel blade graduated on both sides: ALWAYS RIGHT FOR ANY MEASUREMENT! . . . direct reading inside measure: QUICK AND EASY TO USE! . . . mirror-chromed case: STREAMLINE'S FUNCTIONAL BEAUTY LASTS!

MASTER STREAMLINE HAS EVERYTHING!

See, try and buy one now. If you prefer, mail coupon with remittance for your STREAMLINE today!

MASTER

REG. U.S. PAT. OFF.

WOOD AND STEEL TAPE RULES

Master Rule Mfg. Co., Inc. PS-10
201 Main Street, White Plains, N. Y.
I enclose $2.25 for the 6 ft. Streamline
$2.50 for the 8 ft. Streamline
Engrave my name (75c extra). Please print clearly.
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If you like fine tools

. . . then you'll really enjoy the smooth, fast action of the "GREENLEE 22" Solid-Center Auger Bit. And you know it reaches you "factory sharp," for each is *Plastic-Sealed* with a special protective coating. Ask your hardware dealer for "GREENLEE 22."

TOOLS FOR CRAFTSMEN
GREENLEE

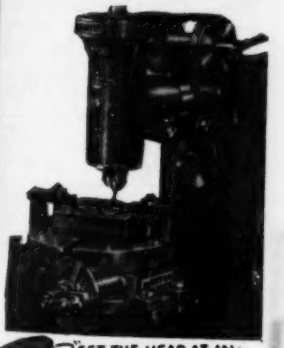
SPECIAL OFFER . . . WOODWORKING CALCULATOR . . . 10¢. Quick solutions to countless problems . . . converting linear to board feet, nail and bit sizes, etc. Send 10c to Greenlee Tool Co., 2130 Columbia Ave., Rockford, Ill.

Increase the Versatility of Your ATLAS Bench Mills

400%

With the MARVIN VERTICAL MILL ATTACHMENT *and* ROTARY TABLE

NEW!



The 6" MARVIN Rotary Table cannot be matched for price — extremely rigid, furnished with index plates and hand wheel.

MARVIN R-1102 ROTARY TABLE

$93.00 F.O.B. FACTORY

Marv and Vic really do have something to interest you bench mill owners. The Marvin V-1200 Vertical Mill Attachment is the most valuable addition you can make to your present mill. Simplicity, quick job change-over, ease of attachment, and high performance characteristics give you all the benefits of a new and expensive machine tool at extremely low cost — without taking additional space. Mail coupon today for literature and prices on the full Marvin line of Bench Mill Attachments, including Slotting Attachment and Rotary Table.

MARVIN V-1200 VERTICAL MILL ATTACHMENT **$65.00** F.O.B. FACTORY

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BRAND NEW

HALE FIRE and IRRIGATION
High Volume
CENTRIFUGAL PUMP

For Fire Protection, Irrigation, De-Watering, Industrial Uses, Farm Uses, Etc.

Pumps Rated 500 Gallons Per Minute at 275 Ft. Head Pressure

Equipped with 1½" diameter straight splined shaft for direct coupling drive; 4½" threaded suction intake; two—2½" threaded discharge outlets; Hale Pump Co. Model CF volute type; use any 4 or 6 cylinder gas engine or couple directly to front of truck or auto; or use 25 H.P. electric motor; dimensions 21" x 34" x 28". Complete with full accessory kit including suction and pressure gauges, priming equipment, and instruction book. Ship. wt. 415 lbs.

NOW **$149.50**

GOV'T ACQUISITION COST $425.00 (ITEM #46) F.O.B. Chicago

WATEROUS PUMP

Rated 500 GPM at 120 P.S.I.

This high efficiency pump is designed for front end mounting on General Motors, Dodge and Ford trucks. Comes complete with gear box for speed step-up; easily mounted for drive from crank shaft. Net wt. 500 lbs. Ship. wt. 1200 lbs. A REAL BUY....

$149.50 F.O.B. Chicago

Hydraulic Cylinders-Air or Oil

Use hydraulics on arbor presses, hydraulic presses, hay lifts, manure loaders, lift trucks—push or pull, tilt or turn, press or squeeze, open or close, lift or lower—and other hydraulic and industrial applications. Use with either air or oil . . . of finest precision workmanship. BRAND NEW.

ITEM #4—Double action, 1" bore, 3" stroke, will lift 770 lbs. in 1/10 of a second using Logan Pump. All steel barrel. Ideal for controls, door openers, positioning, etc. An $18.00 value.... **postpaid** **$4.95**

ITEM #32—Double action, 1½" bore, 9" stroke, will lift 1760 lbs. in one second with Logan Pump. Wt. 4 lbs. A $45.00 value..... **postpaid** **$10.95**

ITEM #16—Use these cylinders on farm trucks, bulldozers, hay lifts, manure loaders, etc. Double action, 1½" bore, 27" stroke. (Will lift 1760 lbs. in 2 seconds with Logan Pump.) Wt. 8 lbs. A $55.00 hydraulic cylinder value for only... **postpaid** **$12.95**

ITEM #17—Double action, 2⅜" bore, 8" stroke. (Will lift 4400 lbs. in one second with Logan Pump.) Will withstand 1500 P.S.I. against wall. Wt. 7 lbs. A $65.00 value..... **postpaid,** **$14.50**

ITEM #20—Double action 2⅜" bore, 4" stroke, two-way solid ⅝" alloy steel shaft (will lift 4400 lbs. in one second with Logan Pump). A $73.00 value..... **postpaid** **$16.50**

ITEM #15—Double action, 3" bore, 8½" stroke. All steel hydraulic cylinder, will lift up to 12,000 lbs. (7000 lbs. in 3 seconds with Logan Pump). Complete with fittings. Wt. 12 lbs. A $78.00 value..... **postpaid** **$19.50**

Item # 31. Double action, 3½" bore, 11" stroke. (Will lift 9600 lbs. in 7 seconds using Logan Pump.) Complete with fittings. Wt. 15 lbs. A $92.00 value..... **postpaid** **$22.50**

Item # 6. Double action, 3" bore, 23" stroke, hydraulic cylinder will lift 7070 lbs. in 5½ seconds using Logan Hydraulic Pump. Especially suited for farm and construction machinery. Clevis mounting for easy use. Wt. 22 lbs. A $145.00 value. **F.O.B. Chicago**..... **$27.50**

ITEM #42—Double action hydraulic cylinder, 4" bore, 18" stroke. Rated lift capacity with 1000 P.S.I. input is 12,560 lbs. using Logan Pump. Ship. wt. 30 lbs. AN EXCELLENT VALUE for..... **F.O.B. Chicago** **$32.50**

HI-PRESSURE FITTINGS for cylinders and valves available at 35c ea. for ⅜" pipe and 50c ea. for ½" pipe.

CENTRIFUGAL PUMP
BELT DRIVEN READY FOR USE ON ANY LIQUID PUMPING NEED

Brand New

A super value for all types of intermittent service in pumping large volumes of liquid in home, farm and industrial service. Ideal for home water systems, draining basements, fire protection, etc. On the farm for watering stock, draining ponds, sprinkling, etc. In shops and factories for all types of pumping service.

Use It for Draining Basements • Home Water Systems • Irrigation • Stock Watering • Fire Protection • Draining Ponds, Tanks, etc. • Industrial Pumping

MOVE LARGE VOLUME QUICKLY. When operated at 1750 RPM, will pump 42 gallons per minute on a 23 foot head; at 3600 RPM on 52 foot head will pump 88 gallons per minute. May be run with electric motor, gas engine or power take-off on tractor.

COMPLETE ENGINEERING REPORTS AND OPERATING INSTRUCTIONS FREE WITH PUMP

Pump has cast aluminum housing—accurately machined bronze impeller vanes. Complete with mounting bracket and 3½" V belt pulley. Shaft rotates on sealed ball bearings with grease gun fitting. Has 1½" threaded intake flange, two 1 inch outlets. Use one or both, as necessary. Made for Packard Motor Car Co. for use in Rolls-Royce Merlin Aircraft engines.

Greatest Pump Value in Years

Shipping weight 23 lbs. You can't beat this value at anywhere near this price. Satisfaction guaranteed.

Complete with Pulley and Mounting Bracket — Ready for Use.

Original Cost Approx. $147.00.

(Item #64) F.O.B. Chicago **$29.75**

Be Prepared with an Auxiliary AC
LIGHT PLANT GENERATOR

(ITEM #67).

Ideal For:

• **Home Lighting** • **Hunting Lodges** • **Stand-by electricity** • **Running all AC electrical appliances incl. fans, motors, electric razors, refrigerators, incubators, etc.**

Protection for emergencies to operate oil burner, stoker, freezer, water pump and lights. These units built to exacting Signal Corps specifications are the answer to your lighting needs. Drive it with a 2½ H.P. gasoline engine at 1800 R.P.M.

• **800 watts** • **0-150 voltmeter with regulator** • **110 volts-60 cycle, AC. Ship. wt. 60 lbs.**

AN OUTSTANDING VALUE for..... **$59.50** F.O.B. Chicago

HYDRAULIC CONTROL VALVES

LOGAN HEAVY DUTY OIL
Hydraulic Control Valve

(Item #37)

BRAND NEW control valve with built-in adjustable relief valve, will operate one double-acting hydraulic cylinder or two cylinders as one or a reversible hydraulic motor. Valve handle latches in neutral position. Made of rugged cast aluminum alloy. Open center unloads the pump in neutral position. Throttling control allows operator to regulate the speed of movement of the hydraulic cylinder or motor. Has removable mounting brackets with 4 bolt holes, ⅜" pipe thread connections. Overall dimen.: 12½" Hx8½"Dx8"W. Ship. wt. 17 lbs. Govt. Acquisition Cost over $100.00. An Excellent Buy. **F.O.B. Chicago** **$21.95**

BRAND NEW

Item # 24. Four-way control valve for use with double action hydraulic cylinder, may be used with 1500 P.S.I. hydraulic system to open and close hydraulic cylinders. Brand new. Ship. wt. 4 lbs. A $38.00 value... **postpaid** **$7.95**

Item #26. Four-way control valve for use with two hydraulic double action cylinders. Each cylinder may be operated independently of the other or in conjunction with the other. Oil may be locked in any of the cylinders to hold the piston at any required position. Brand New. Ship. wt. 6 lbs. A $60 value **postpaid** **$10.95**

Item #28. A two cylinder double action valve with a unique arrangement, allowing the operator to raise both cylinders simultaneously, to lower them simultaneously or to raise one and lower the other at any predetermined rate and speed. Brand New. Ship. wt. 8 lbs. A $75.00 value..... **postpaid** **$14.95**

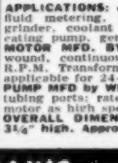
ADJUSTABLE RELIEF VALVE. (ITEM #34)..... **$2.95** postpaid

HYDRAULIC FLUID. (ITEM #53.) Per gallon F.O.B. Chicago..... **$1.75**

10 ft. length of Hi-Pressure HYDRAULIC HOSE, with ¼" female pipe thread fittings. (ITEM #27). F.O.B. Chicago..... **$3.95**

Brand New HYDRAULIC TANK, 3 gallon capacity with oil-indicator cap. 4" x 12" x 13½". Ship. wt. 13 lbs. NOW AT THIS LOWEST PRICE. (ITEM #58.) F.O.B. Chicago..... **$4.95**

BRAND NEW GEAR TYPE
INSECTICIDE PUMP



All Manganese Bronze for spraying D.D.T., 2-4D, Sulphur Compounds, Etc. Pressures up to 150 lbs. to 14 gallons per minute—1500 RPM. Will not rust, pit, foul or freeze up. Use rubber hose inlet, pipe or tubing outlet. Equipped with ½" standard pipe thread port. Wt. 10 lbs. Dimen.: 8" x 5" x 6½". Standard 1" manganese bronze shaft with keyway. U. S. Gov't Acquisition Cost $62.00..... **NOW ONLY** F.O.B. Chicago **$15.00**

(Item #50)

Self-Priming
ELECTRIC PUMP

Compact—Brand New

APPLICATIONS: oil burners, aquariums, fluid metering, fuel pump, tool post grinder, coolant pump, pressure lubricating pump, general industrial, etc.

MOTOR MFD. BY BLACK & DECKER: double ball bearing series wound, continuous duty, 1/30 H.P. electric motor, rated 12,000 R.P.M. Transformer included for use on 110 V AC current. Also applicable for 24-32 V DC.

PUMP MFD by WELDON TOOL CO. with standard ¼" tubing ports; rated 2 G.P.H.; remove pump and use motor as high speed grinder.

OVERALL DIMENSIONS: 7¾" long x 3½" wide x 3¼" high. Approx. wt. 5 lbs. $51.00 value (Item #1) postpaid **$12.95**

SHOP by MAIL - SAVE at GROBAN'S - Buy Direct from ad!

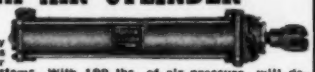
All Merchandise Brand New - Order Today - Satisfaction Guaranteed!

LOGAN HEAVY DUTY OIL HYDRAULIC PUMP

BRAND NEW . . . for operating hydraulic cylinders and hydraulic motors on tractors, bulldozers, construction machinery, lift trucks, industrial applications, etc. Delivers 8 GPM at 1200 RPM at 1000 P.S.I. using 5 H.P. Has 1½" pipe thread inlet, ⅜" pipe thread outlet. ¾" shaft with flat and keyway for direct or pulley drive. Has flange with 4 bolt holes for convenient mounting. Ship. wt. 22 lbs. Overall dimen.: 7" L x 5½" H x 5½" W. A $105.00 value. FOR ONLY **$22.50** F.O.B. Chicago (Item #29)

HANNA AIR CYLINDER

Brand New



Used for heavy duty industrial applications on shop air lines or with low pressure systems. With 100 lbs. of air pressure, will deliver 1900 lbs. pressure at the ram shaft. All steel construction. Adjustable cushions at both ends of cylinder. Shaft dia. 1½". Foot mounting with clevis on ram shaft. 26½" double-acting stroke; 5" bore, 40½" overall length closed, 7" overall width. 89½ lbs. net wt. Gov't. acq. cost $101.85. (ITEM #61) AN EXCELLENT VALUE for **$39.50** F.O.B. Chicago

HAND HYDRAULIC PUMP

BRAND NEW

Used for hydraulic jacks, presses, hoists and other hydraulic applications. For operating hydraulic cylinders to pump oil or hydraulic fluid under pressure. Hand pump has built-in check valve and is capable of delivering 1000 lbs. of pressure. Has alloy aluminum housing. Dimen.: 8" long x 3½" high x 2¾" wide. Ship. wt. 3 lbs. A $45.00 value. (Item #11) . . . . Now **$8.95** postpaid

NOW . . . It's Easy to Weld with this handy ELECTRIC ARC WELDER

Designed for many years of trouble-free service! Handles anything from light gauge sheet metal to ½" plate.

This precision-engineered direct current ELECTRIC ARC WELDER is offered at but a fraction of its original value. It can be mounted permanently or easily transported for portable use. Does the job instantly, where and when you need it.

The War Surplus generators for these Arc Welders were built by General Electric, Westinghouse, and Delco-Remy at a cost of over $300.00. They are light in weight; have oversized lifetime grease-sealed ball bearings; air-cooled commutator; dial type rheostat for easy pinpoint control; high-low range switch; reactor coil for even arc; handles 1/16 to 3/16" rods. Run welder at 2500 H.P.M. from drive pulley or power take-off of tractor, a 7½ H.P. electric motor or a 10 H.P. gas engine. Use one or two V-belts, or flat belts (on pulley). Continuous welding rating—70 amps.; intermittent rating—250 amps.; 0-60 volts. Now . . . AT A FRACTION OF ITS VALUE. Price includes double V or flat belt pulley and instruction book. Ship. wt. 95 lbs. Only one or two jobs will pay for entire welder. **$99.50**
(Item #65) F.O.B. Chicago
ACCESSORY KIT including welding helmet, electrode holder, two 10 ft. cables with clamp, and 5 lbs. of assorted welding rods. **$10.50**
(Item #66) F.O.B. Chicago
Remember, Satisfaction is Guaranteed

ROSS 4-Way Foot Operated AIR VALVE MODEL 398

BRAND NEW. For double-acting pneumatic devices. Fine for operating presses, air vises, air machinery of many types. Heavy duty cast construction. No neutral position. Maintains pressure against the piston when the foot control is in the "Up" position. Threaded for ½" pipe. Dimensions of valve body: 7¾"L x 4¼"W x 7½"H. Net wt. 28 lbs. A $64.60 value for only **$19.50**
(ITEM #60) F.O.B. Chicago

LOGAN 4-Way Foot Operated AIR VALVE

Model 6520

BRAND NEW. For double-acting pneumatic devices. Fine for operating air vises, presses, air machinery of many types. Heavy cast construction. Threaded for ½" pipe. Dimensions of valve body: 8½"L x 5¾"W x 7½"H. Net Wt. 28 lbs. Gov't acquisition cost $42.00. AN OUTSTANDING BUY AT **$15.00**
(ITEM #59) F.O.B. Chicago

Vickers MF9 Hydraulic PUMP or MOTOR

complete with mounting kit ready to install **$19.90** postpaid

$75.00 value

Pump is compact, powerful, rated 1,000 P.S.I., .507 cu. in. per revolution, 8 gal. per min. at 3750 RPM. Change rotation by reversing flow. Delivers up to 6 H.P. Requires ½ to 6 H.P. to drive directly or by pulley. BRAND NEW.

Mounting kit has been especially designed to provide maximum utility and ease of mounting MF Series Vickers Pumps. Brackets are constructed of heavy steel plate; shaft is made of ½" steel with one end splined to fit pump; other end of shaft has machined flat for mounting a standard pulley with ½" hole. Shaft runs in oilite bronze bearings.

(Item #18) Pump only . . . . . $14.95 postpaid
(Item #38) Mounting kit only . . . . . $ 4.95 postpaid
(Item #39) Both as complete unit . . . . . $19.90 postpaid

FREE CATALOG!

Write for free copy of our 40 page catalog including Hydraulic Manual featuring diagrams, photographs and instructions. Catalog lists excellent war surplus values: pumps, valves, hydraulics, lights, motors, etc.

G-1 Stainless Tank

Use these tanks on compressors, for tire inflators, pulsation chambers, floats, buoys, hydraulic reservoirs, fluid and milk containers, fuel containers, etc. Tough, light. 450 lbs. P.S.I. Aviators Breathing Oxygen bottles, type G1, 2100 cu. in. (approx. 9 gallons) int. vol. 24" x 12", ½" threaded openings at ea. end. Wt. 19 lbs. (.51" thick). **$4.95** ea.
(ITEM #63) F.O.B. Chicago

SCREW JACK

BRAND NEW **$3.95** POSTPAID

Ideal for raising, lowering, leveling and adjusting. Use on tables, machine tools, toys, etc. Overall length closed 9 inches, open 14 inches. Worm gear box with 54 to 1 reduction, with double end drive shaft. Use either end or both. Extension screw shaft 30 to 1 reduction. $35.00 value.
(Item #45) AN OUTSTANDING BUY

BRAND NEW GENERAL ELECTRIC 8" SEALED BEAM UTILITY SPOTLIGHT

300 Watts, 110 Volts, A.C.-D.C.

Has countless uses for: • Homes • Garages • Workshops • Driveways • Outdoor advertising • Displays • Beach lighting • Private air ports • Photography. Wherever you need flood-lighting!

Bought by the U. S. Army for signal use. This is the greatest surplus bargain ever offered.

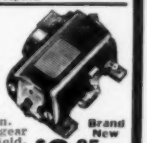
Lens, reflector and electrode vacuum sealed in one dustproof, air tight unit. 300 Watts, 110 Volts. Weighs only 2½ lbs. List price $10.50 (Lamp only)

A TREMENDOUS VALUE for . . . . . **$2.75** ea. postpaid
(Item #8) 12 or more $2.50 ea. postpaid

SHOCK ABSORBERS

Use them to spring suspend vehicles, hoists, pumps, heavy and light machinery, compressors, etc. 11" x 2" dia. Welded steel construction for extra strength—U. S. Air Force bought them for bomber gas tank shock absorbers. Rated 2500 lbs. Ship. wt. of 4—11 lbs. **4 for $5.00**
(Item #21) Each . $1.50 F.O.B. CHICAGO F.O.B. Chicago

MINIATURE HIGH SPEED Electric Motor

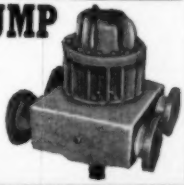


Ideal for Model Builders, Model Railroaders, Experimenters, Hobbyists.

AC or DC. Reversible, speed may be regulated by varying voltage. Has miniature Klixon thermostatic switch. All connections are external and accessible. Has 3 mounting feet for easy installation. Double-end ball bearing supported shaft with small gear on one end. Die-cast housing with laminated field. Overall Dimen.: 3¼" long x 2⅝" wide x 1¾" high. Net wt. 12 oz. A $22.00 VALUE . . . . . (Item #5) Brand New **$2.95** postpaid

ROPER LUBE PUMP

Model C-75



This reversible pump is especially designed for delivering at least 50 GPM of lubricating oil, diesel fuel, molasses, tar, pitch, lacquer and similar fluids at 80 P.S.I. using 4½ H.P., at 400 R.P.M. 1¾" keyed shaft. Select any two of the four flanges for inlet and outlet. Ship. wt. 200 lbs. A $377.00 value —NOW offered at **$39.50**
(Item #69) F.O.B. Chicago

18" Wire Spoke Wheel

BRAND NEW. For use on motorcycle or adaptable for midget cars, trailers, small trucks, any wheeled vehicle. With bearing races and gear. Takes 18" tire. Wt. 19 lbs. **$3.95** each F.O.B. Chicago
(Item #57) A REAL VALUE at

GROBAN SUPPLY CO. 1507 SOUTH MICHIGAN AVE. Chicago 5, Ill. Dept. PS-10

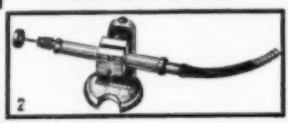
Now! FOREDOM offers 2 NEW ATTACHMENTS

You Get Unexcelled UTILITY AND VERSATILITY . . . AT SMALL COST!

DRILL PRESS ATTACHMENT

1. Now Foredom offers you a DRILL PRESS ATTACHMENT for use with Model 100 (see below) and for the many thousands of Foredoms already in use. Handpiece quickly clamps in place and drill press is ready for use, ready to pay for itself over and over again! PRICED AT A MERE $4.95.

—but there's more!



B-R-S ATTACHMENT

2. The new Foredom B-R-S ATTACHMENT (Bench Stand, Router, Shaper). Speedily clamp handpiece in place and magically you have one unit which serves as a bench grinder with angular adjustment, a router (complete with detachable guide for routing borders) and shaper. Can be used with Model 100 and thousands of Foredoms now in use, providing endless hours of fun and profit. TRIPLE UTILITY FOR ONLY $3.50.

And there's still more—

FOREDOM'S NEW MODEL 100 FLEXIBLE SHAFT MACHINE

35" Flexible Shaft

$16.95 COMPLETE WITH MOTOR

Model 100 Flexible Shaft Machine with all-metal PENCIL SIZE HANDPIECE equipped with CHUCK GUARD to PROTECT YOUR FINGERS and provide SENSITIVE, POSITIVE, FINGER-TIP CONTROL for the most delicate tasks. Husky little high-speed universal motor. Foredom's quarter-century reputation for precision workmanship goes with each machine. Other heavier duty models at proportionately reasonable prices. No. 25 Accessory Set (a truly versatile assortment) $5.50 extra. Also No. 1000 Kit, comprises No. 100 Machine illustrated and set of 12 accessories, all in wooden case for only $21.50. 6-step Foot Rheostat $4.85. USE IT to GRIND, POLISH, DRILL, SAW, SAND, CARVE, MILL, CLEAN, ETCH, ENGRAVE, ETC. on all metals, wood, plastics, glass, leather, linoleum, etc.

And here's another Amazing Foredom Product

FOREDOM PRESTO-FLEX with PENCIL-SIZE handpiece

Quickly Converts Motors or Drills into Flexible Shaft Tools **$5.95**

Now turn your old motor, drill press or electric drill into a Flexible Shaft Tool. Simply attach it and presto—a flexible shaft machine! Off again in a jiffy! Pencil-Size handpiece gets into tight places. Handy 35" overall length. And—only $5.95 complete! Precision made. Order NOW. If ordered for use on motor, specify motor shaft diameter and add 50c for coupling (Available for 1/4, 5/16, 3/8, and 1/2" shafts). No. 50 Accessory Set available $1.50 extra. Order TODAY, at your dealer's or use coupon below.

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Please send me FOREDOMS checked below on 10-day trial.

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- ☐ B-R-S Attachment ($3.50)
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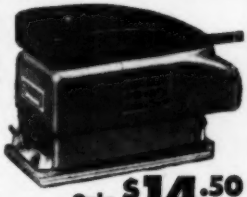

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A refill now cuts repair bills later

MONEY-SAVING TEAM New oil *and* a Purolator Micronic Refill to keep it free from abrasives. Result, top engine performance, lower repair bills.

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*Depending on make of car.

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Has big precision ground table for work on long boards

- ★ 42" Precision-Ground Grey-Iron Table
- ★ 32" Two-Way Tilting Fence Rigidly Supported at Two Points Close to Cutter Head
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- ★ Cutter Head Raises or Lowers for Simultaneous Blade-Height Control
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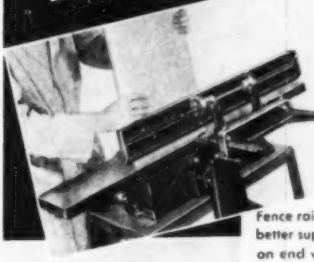
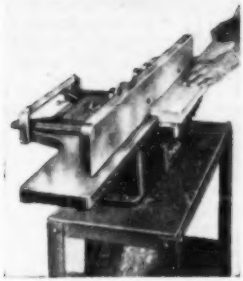
- ★ Sealed for Life Ball Bearings
- ★ Extra Heavy Construction Throughout — Big Capacity

Atlas engineers stepped far out ahead of the field for you in developing this new 6" jointer-planer. Precision-built, ruggedly built — *it includes features never before provided in a 6" jointer.* On all your fine furniture and cabinet work it brings you new ease and speed on planing, beveling, tongueing, rabbeting, end-joining, and edging. Gives you a professional "factory job" on everything you undertake.

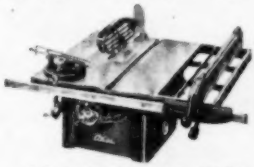


Fence raises for better support on end work

In the Atlas, for the first time, you get *simultaneous blade positioning.* The whole cutter head raises or lowers for alignment, or comes out for resharpening blades without disturbing their setting. That's but one of many features to save you time and improve workmanship. Send a postcard for latest literature with all the facts.



The only Jointer-Planer with a scale to set table widths. Saves time — promotes more accurate workmanship



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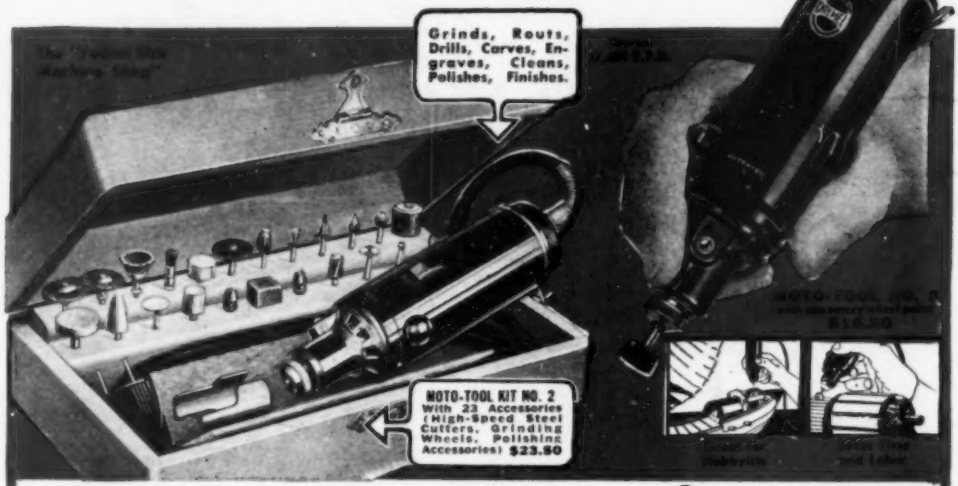
DREMEL *Electric* MOTO-TOOL



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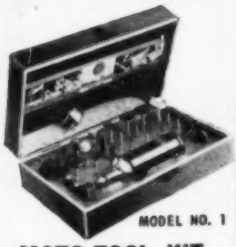

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Makes play of wax polishing

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SAFE! AS A HANDSAW

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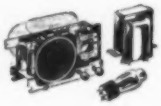

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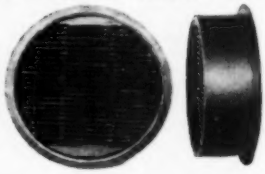
New government surplus made by Goodrich. Protects you from cold, dampness and wind, from the top of your head to the tip of your toes. FOR Duck hunters—tractor drivers—miners—flagmen—police—firemen—equipment operators—farmers—watchmen—seamen—plumbers—truckers. Good for rescue work on ice or in cold waters. With belt released a life jacket can be worn inside of suit. These suits are built similar to regular hip boots or waders. The shoes and gloves have a sure grip surface. The suit is waterproof up to the neck; it has sleeves and a hood. The rubber is vulcanized to a fabric lining. This suit is easy to slip on over your regular clothes and shoes. Sizes are all large. They have a waist belt for taking up slack. If suit is used in or near deep water use a standard life jacket inside of suit. These are the famous overboard suits made for seamen who were forced to abandon ship in freezing waters. All suits are in perfectly new condition. Color black.

DARKROOM VENTILATORS

13½" DIAMETER



4½" THICK • STEEL

VENTILATE YOUR DARKROOM

$25.00 Value—PRICE $7.50 set or $4.00 Each

New government surplus. Air flows through these steel louvers freely due to the arrangement of baffle plates. Light does not show through these ventilators. Hundreds of these vents have been installed in darkrooms. You will need two for your darkroom. Install one in or near the ceiling and one near the floor. $7.50 for set of two or $4.00 each.

ARMY SURPLUS SALES OF FRESNO
1820 Tulare Street **Fresno, Calif.**

NEW SHERRILL COMPASS

$25.00 VALUE PRICE $5.95 Postage Paid

ARMY TANK COMPASS

These compasses were built to rigid government specifications for modern army tanks, and are known for their high degree of efficiency and ruggedness. It is a very useful instrument for universal installations, such as boats, planes, cars, trucks, tractors, etc.

These compasses are new in original cases with compensators for horizontal corrections, magnetism correctors, calculator, adjustable mounting brackets, and instruction book. Compass size 5" high by 3½" dia., weight 1 lb. 6 oz. This is truly a fine compass and a real value for only $5.95.

ARMY SURPLUS SPECIALS

Twin beds—hardwood 2 beds, 2 springs, 2 new mattresses, 2 feather pillows.	Value $50.00	**Our Price $19.50**
Mattresses, new 23 lb.—size 30"x74"	Value $9.50	**Our Price $5.25**
Blankets, new, 64"x84", grey or O. D.	Value $7.50	**Our Price $3.95**
Oxfords, black & brown. Military type	Value $7.95	**Our Price $4.95**
Jackets, all sizes, waterproof, sheepskin lined.	Value $29.00	**Our Price $17.50**
8,000 candlepower, carbide flood lights.	Value $51.00	**Our Price $9.50**
Rifle covers, waterproof, size 10"x56"	Value $2.00	**Our Price 4 for $1.00**
Hunting knife & sheath—polished chrome.	Value $4.50	**Our Price $1.95**
5 gal. jeep gas can, galvanized with spout.	Value $3.95	**Our Price $1.95**
Rigid screw extractor set, No. 10, a mechanics friend.	Value $12.00	**Our Price $5.95**
1" drive, Snap-on, socket set with ratchet. 13 pieces	Value $75.00	**Our Price $37.50**
⅜" drive ratchet—plated.	Value $3.50	**Our Price $1.95**
½" drive ratchet plomb—plated.	Value $6.50	**Our Price $2.95**

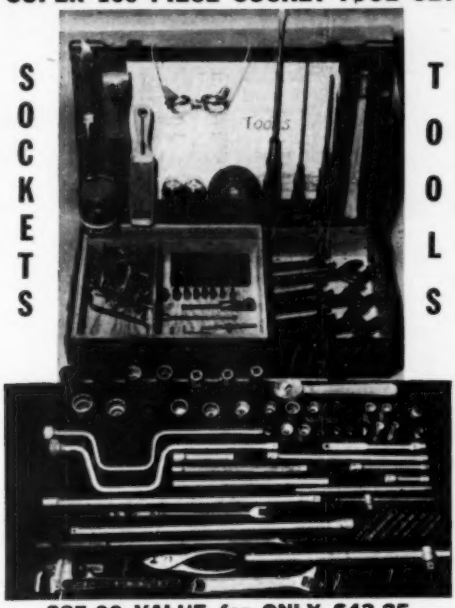
Send for catalog on home utility power hand tools, electric drills, portable electric saws, etc. The best medium-priced electric tools for less. We pay all postage on power hand tools

All orders are filled the day they arrive. Pay by check or money order. 25% dep. on C.O.D.'s. Prices are F.O.B. Fresno, except for rubber suits and compasses on which we pay postage. All items listed are new, except for bunk beds and jeep cans.

ARMY SURPLUS SALES
OF FRESNO
1820 TULARE ST., FRESNO, CALIF.

SUPER 100 PIECE SOCKET-TOOL SET

SOCKETS



TOOLS

$85.00 VALUE for ONLY $43.25

Our purchase of over 200,000 wrenches as unused U. S. Airforce surplus makes this low price possible. All tools are NEW, all sockets are plated. They are well-known popular standard makes such as Plomb, Snap-On, etc. Set consists of over 100 tools and a husky tool chest that will last you a lifetime. This is what you get—

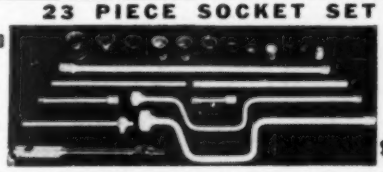
½" DRIVE SOCKETS & ACCESSORIES
7 Deep Sockets ¾" to 1⅛"
1—7/16" socket
1—½" socket
1—9/16" socket
1—⅝" socket
1—11/16" socket
1—¾" socket
1—Adapter ½" to ⅜" Drive
1—13/16" socket
1—⅞" socket
1—15/16" socket
1—1" socket
1—1-1/16" socket
1—1⅛" socket
1—1-3/16" socket
1—1¼" socket
1 Ratchet Handle
1 Speed Handle
1 18" Flex Handle
1 10" Flex Handle
1—T-Handle
1 Bar Handle
1 18" Extension
1 10" Extension
1 4" Extension
1 10" Pipe Wrench
1 10" Adjustable Wrench
1 Pair Pliers
1 Chrome Hunting Knife
1 Plastic Mallet
8 Box Open-End Wrenches for Carburetors, Ignitions, and Radios
1000 Cotter Keys, 25 sizes
1 Cotter Key Puller

⅜" DRIVE SOCKETS & ACCESSORIES
1—¼" socket
1—5/16" socket
1—⅜" D-socket
1—7/16" D-socket
1—½" D-socket
1—½" socket
1—9/16" socket
1—9/16" D-socket
1—⅝" socket
1—11/16" socket
1—¾" socket
1 Speed Handle
2 Flex Handle
1 T-Handle
1 Bar Handle
1 10" Extension
1 4" Extension
1 2" Extension

¼" DRIVE SOCKETS & ACCESSORIES
The ¼" drive is a 12-piece set with steel box
1 10" screw driver
1 Cabinet Screw driver
1 Cross point screw driver
2 Cans plastic water proof glue
1 File Card & brush
1 pair safety goggles
2 one-cell trouble lights
1 larger roll friction tape
4 Allen wrenches
10 End wrenches 7/16" to 1½"

23 PIECE SOCKET SET

$20 VALUE



PRICE $9.50

Set consists of 23 pieces, ½" and ⅜" drive. Same quality as above set. Shipping weight 10 pounds. This is what you get.

1—¼" Socket	1—13/16" Socket	1—2" Extension
1—5/16" Socket	1—⅞" Socket	1—4" Extension
1—⅜" Socket	1—15/16" Socket	1—18" Extension
1—½" Socket	1—1" Socket	1—T-Handle
1—9/16" Socket	1—1-1/16" Socket	1—Flex Handle
1—⅝" Socket	1—1⅛" Socket	1—⅜" Speed Handle
1—11/16" Socket	2—Bar Handles	1—½" Speed Handle
1—¾" Socket		

ARMY SURPLUS SALES OF FRESNO
1820 Tulare Street **Fresno, Calif.**

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UTICA TOOLS have smooth working joints

Made better to last longer...

Good Craftsmen Work Better With Good Tools

Utica Tools—accurately designed and produced..respond with precision to the will of good craftsmen . . mean fine workmanship!

Six precision machining operations on the joint are completed at one setting . . assuring a smooth-riding and easy working joint, and thousands of clean cuts with minimum effort!

TOOL NO. 50
Electricians' Standard Side Cutting Pliers
4", 5", 6", 7", 8"

U T C A
Utica Tools
FOR MORE TOOL MILEAGE

UTICA DROP FORGE and TOOL CORP., UTICA 4, NEW YORK

SAVE 1/2 ... BUILD
Modern Kitchen Cabinets YOURSELF

with EASI-BILD* Patterns

Now you can have modern, professional looking cabinets with gleaming Stanley Cabinet Hardware in *your* kitchen, bathroom or playroom. It's easy—and inexpensive—when you use the Easi-Bild "Build-It-Yourself" Pattern Method of construction. Simplifies making base and wall cabinets with hand tools. Complete step-by-step directions, patterns, assembly illustrations explain how to build cabinets to exact size needed. Send only $1.00 for Easi-Bild Base and Wall Cabinet Pattern, No. 201.

EASI-BILD PATTERN CO., Dept. PS, P. O. Box 215, Pleasantville, N. Y.

STANLEY
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6" CONCENTRATED FLAME!

OPERATES 1½ HOURS WITHOUT REFUELING

gives instant flame! intense heat! (1800°F.)

$3.98 POST PAID

Weighs Only 10 oz. Measures 7¼".

Completely Automatic

Here is the amazing and ingenious "Besjet" pocket-size Blow Torch that performs with the efficiency of an expensive, heavy, standard-size blow torch.

Completely automatic, and always ready for use, the "Besjet" requires no priming or pumping. Uses denatured alcohol as a fuel. Just light it and it gives a concentrated 6" flame of 1800°F. in 10 seconds.

Made of sturdy brass with triple plated chrome finish. Absolutely leak-proof, no moving parts to get out of order. Ideal for mechanics or hobbyists!

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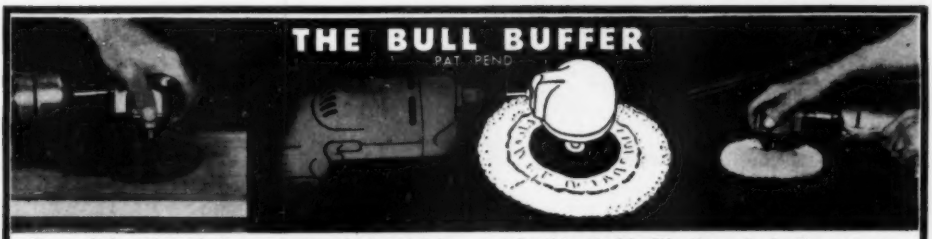
THE BULL BUFFER

PAT. PEND.

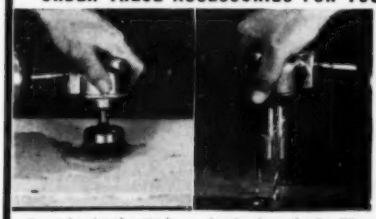


You polish and sand faster, easier—do beautiful, *professional* work—with this amazing new attachment for your hand drill. And it more than pays for itself *the very first time* you polish and sand your car, floors, woodwork, furniture.

The Bull Buffer fits any chuck on an electric drill (or flexible shaft). It's the only buffer you can turn *in a complete circle* while you hold your hand drill stationary. Reaches all curved and flat surfaces. It's packed with power, built of lifetime materials and *guaranteed*.

Order today—at your dealer or send cash, check, or money order for your Bull Buffer, complete as pictured below..... **$9.95**

ORDER THESE ACCESSORIES FOR YOUR BULL BUFFER:



Cup wire brush attachment for removing paint, rust, scale, etc. $1.75

Jacobs key chuck: When attached to Bull Buffer, increases 1/4" drill to 1/2" capacity, reduces speed, increases power. $5.00

Bull Buffer car cleaner ..... $ .50

Bull Buffer car polish 1.00

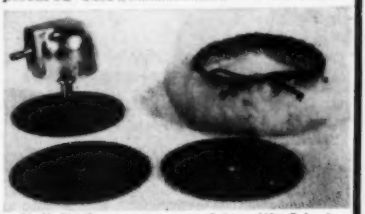
Extra sheepskin bonnet 1.25

Extra sanding discs (0000-000-00-0-1-2 1/2-3-4) Each 10c

1/2" Jacobs No. 6425 key chuck (see photo) .. 5.00

2 1/2" cup wire brush (see photo) 1.75

Adapter B set for sanding at twice drill speed..... $2.00



Bull Buffer comes complete with 5-inch rubber disc, sheepskin bonnet, and 2 sanding discs, only $9.95.

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Using Standard Attachments it:

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Taps	Drives Studs
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The Ingersoll-Rand Impactool runs like any other electric tool until it encounters hard work—then automatically converts its power into hundreds of powerful "rotary" impact blows. The Impactool powered with an *air* motor has been built for over 17 years. Now, for the first time, this tried and proven multi-purpose tool is available to all powered with an *electric* motor.

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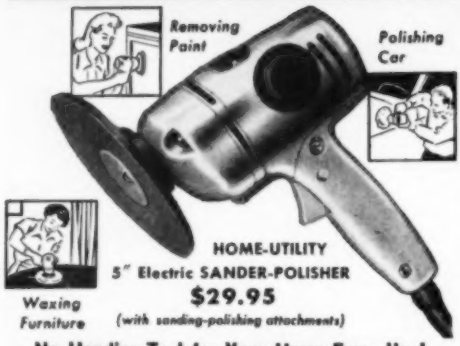

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$29.95
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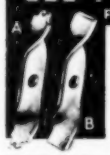
FOR JOINTING & CUTTING MOULDINGS



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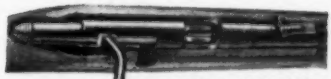
... the *Only* single shot bolt action .22 that gives you these features at this *LOW* price!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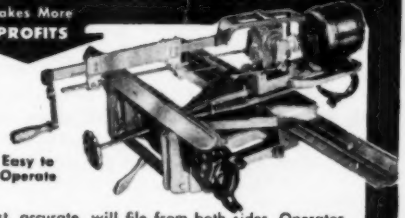

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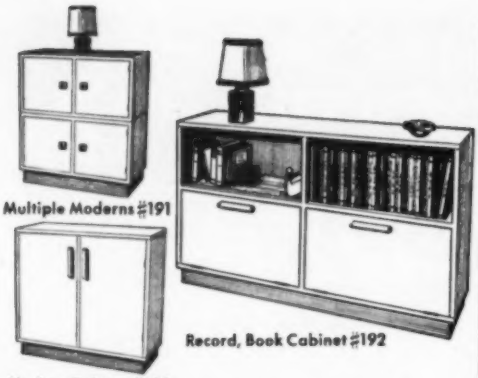

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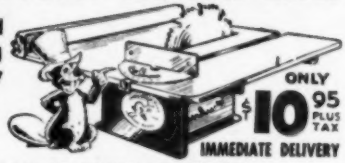

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5/16"	1/2"	Needle	15c
39/64"	1 1/8"	Ball	25c
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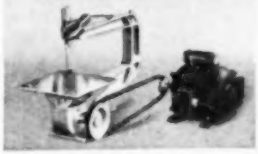

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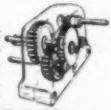

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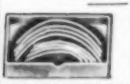

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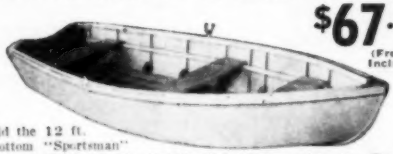

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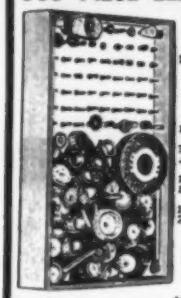

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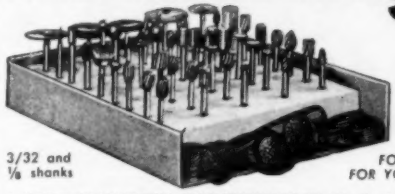

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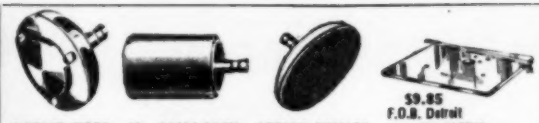

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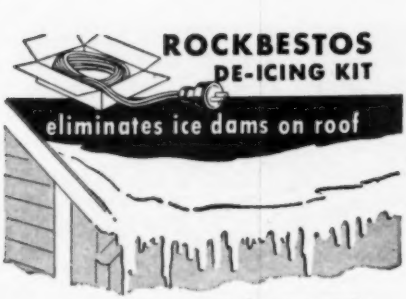

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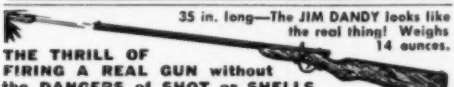

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SERIES A: Cricket, spice cabinet & mirror, knife & fork box, match box, miniature blanket chest, nutmeg box, wall rack, napkin holder, colonial mirror, desk box, miniature cradle, mirror, shelf & drawer, tray, pipe & match box, candle stand. **SERIES B:** Miniature cradle tray, trinket box, miniature chest of drawers, spice chest, spice box, corner candle stand, coffee table, book shelf, spice cabinet, salt box, string box, shoeshine cabinet, footstool, kindling box, treasure box.

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THE TOOL BOX OF THE WORLD
Hardware • Hand Tools
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SEND THIS COUPON...TODAY!

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Please send me Series A ( ) and Series B ( ) of the new Early American project plans. I enclose 25¢ for each set.

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This is it!

THE LOWEST-PRICED BALL-BEARING TILT/ARBOR SAW IN AMERICA!

$39.50 F.O.B.

Kalamazoo, Mich.
Price includes motor rail, belt, pulley, mitre gauge, fence, splitter, guard — less motor. Extensions $3.50 each.

THE NEW *Atlas* POWER KING 3001

Yes, this is it! Today's outstanding saw value. The new 3001 ball-bearing tilt/arbor Power King ... with big saw features... yet priced so low it pays for itself on your first few projects! Send postcard for catalog today.

BIG SAW FEATURES!

- ★ ***Tilt/Arbor Construction*** — for safer angle sawing.
- ★ ***Sealed Ball Bearings*** — for smooth, lasting accuracy.
- ★ ***Big Capacity.*** Cuts 2¼" deep. 7⅛" area ahead of blade. 12" x 16" table.
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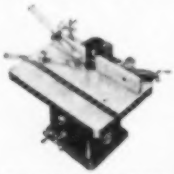
- ★ ***Table Extensions*** — 6¾" x 16" added on sides give you 25½" wide table — 12" from blade to fence!



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Cuts joints, grooving, mouldings, and edge work to add factory-like beauty to furniture and furnishings projects. The PK wood shaper is low cost, with many extra features. See it at your Power King dealers.

12" WOOD LATHE

36" between centers, 4 speeds, threaded for outboard turning, ball bearings. A most unusual value!

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MATCHED PRECISION TOOLS FOR WOODWORKING AND METALWORKING

EASY TO USE

Stops faucet leaks—refinishes seats, inserts new seats. A new all-purpose family kit to end annoying water drip and to repair worn-out faucets . . . Saves water and water-heating expense. Family set includes "Nu-Seater" tools, "Drip-Stopper" tools, brass faucet-seats, washers and illustrated, simple directions.

ASK YOUR DEALER for the O'MALLEY FAUCET REPAIR SET, the new ALL-PURPOSE FAMILY SET. If no dealer, remit direct

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3 SEPARATE TOOLS—
EACH MAKES DIFFERENT WIDTH

Stripe perfect lines—straight, curved, with any paint, lacquer, enamel, easy as drawing lines with ruler! Beautify furniture, toys, autos; make signs and imitation tile. Simple instructions included.

SEND NO MONEY. Mail order. Pay postman only $1.00 plus postage. If not delighted return in 5 days for money back. Order Now.

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Have one of the finest mowers money can buy. Write for FREE PLANS and PARTS LIST showing you how to SAVE up to 75% by assembling Triangle's POWER MOWERS.

3 WHEEL MODEL

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Kits, Parts, Engines, Wheels, Etc. Also complete TRIANGLE MOWERS ready to mow, at Low Factory Prices, 3 and 4 wheel Models.

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SAVE your back. Assemble or build your own 3 or 4 wheel power mower with our precision made kits and parts. Write today for full facts. Free Plans, Parts List, Low Factory Prices. DEALERS INVITED.

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FOR CABINS, TRAILERS, CONTRACTORS, BOATS

Light weight, compact, air-cooled engine-driven. Furnish regular city-type A.C. electricity for lights, appliances, radios, etc. Can be carried by hand. Fit trunk of car. Plug-in receptacles on plant. Larger models for farms, homes, businesses beyond highlines. Catalog shows over hundred models. 350 to 58,000 watts.

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D. W. ONAN & SONS INC.
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NOW a DYNAMIC HEAVY DUTY INDUSTRIAL WELDER

ONLY $28.50 COMPLETE

FOR AUTO—HOME APPLIANCE & FARM IMPLEMENT REPAIRS! WORKS ON IRON, STEEL & other metals . . . does work you'd expect from a larger, costlier machine; portable, easily carried; **OPERATES FROM ANY** properly wired **110 VOLT LINE.** Also available for 220 volt operation at slight additional cost; has 8 metalic & carbon arc welding heat stages. **EASY TO OPERATE TRANSFORMER TYPE WELDER**—If inexperienced you can learn to do professional work by following the **SIMPLIFIED WELDING & OPERATING INSTRUCTIONS FURNISHED**—comes complete ready to operate with helmet, rods, cable, instructions. **SAVE TIME AND MONEY**—Do your own welding—Just a few repair jobs will pay for this machine. A practical and profitable machine tool for any workshop. Make money doing repair work for others. Costs a few cents to operate.

SPECIAL GIFT OFFER! WORTH $6.80 ARC TORCH YOURS at NO EXTRA COST!

Write today for FREE DETAILS, ARC TORCH GIFT OFFER and DYNAMIC WELDER 10-Day Trial Offer.

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Need a Chimney?

You Yourself Can install it . . .
The VAN-PACKER Packaged Chimney

Write for **Free Booklet**

SAFER . . . Underwriters and FHA accepted, any fuel. **ECONOMICAL** save 50% over brick. **ENTIRE CHIMNEY SHIPPED COMPLETE** (convenient 2 ft. sections: base, housing, roof flashing, chimney cap). Nothing else to buy. **PERMANENT** . . . a lifetime chimney. **MORE DRAFT** . . . less soot, better heat.

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MAKE! FOLDING TABLES-BENCHES-HORSES-IN A JIFFY

FOLD-A-WAY CHANNEL STEEL LEGS

Shipped complete, ready to fasten to your top in a minute. Rubber tipped. Used on the job, in homes, workshops, ping pong tables, trailers, camps, boats, churches, lodges, banquet halls. **Send for free circular**

$4.98 Pr. 24" Legs
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Postpaid in U.S.A.

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Dept. PS. 1100 Altamont Ave. Schenectady 7, N.Y.

Easy and Cheap to Operate

SAVE TIME, WORK, MONEY!

SHAW "DU-ALL" and "PEPPY PAL" TRACTORS

PLOW

CULTIVATE

These rugged walking or riding tractors are ideal for farm, truck garden, orchard, poultry farm. Operate on a few cents an hour. A child can handle them.

DO DOZENS OF JOBS Both riding and walking tractors quickly and easily plow, cultivate, harrow, disk, bulldoze, spray, haul, grind, saw wood, etc.

LOW FACTORY PRICES Buy direct or thru your dealer. Year's guarantee.

RIDING TRACTORS Four models from 5 to 12¼ H. P., 58 in. wheelbase, 36 to 52 in. wide, 24 in. plant clearance. Hand or electric starter. Walking Tractors 1½ to 5 H.P.

FREE Illustrated folders giving complete details, price list — write today.

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Wichita, Kansas, Spaces 67 & 68D, Forum Exposition Bldg., Oct. 18-23.

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Complete Super Power Tool Kit — Only

$18.55

Contains power unit with cord, 5 abrasive points and cutting burrs, full operating instructions—all in one case.

New Duro Super Power Unit—the tool you'll use in a 1000 ways!

This is the kind of lightweight, perfectly balanced hand power tool that hobbyists and home craftsmen dream about! A compact fistful of super power, it runs cool and smooth at 20,000 RPM, develops 42 watts output. With it, you can do clean, professional-looking sanding, polishing, grinding, engraving, carving . . . and scores of other operations.

Start with this low cost tool kit and build a complete home workshop! One Duro Super Power Unit is used on all of these home workshop tools! You may buy them singly—or in a group.

Ball Bearing Flexible Shaft Doubles the Fun

New Duro flexible shaft fits over nose-piece of power unit, makes free-hand carving, engraving lots more fun. Flexible shaft, complete with hanger, only.....$15.55

Write for Free Illustrated Circular

giving full details about the Duro Super-Power Unit and the low cost workshop units. Circular also shows almost a score of pictures and details about operations that you can do with these amazing power tools.

DURO METAL PRODUCTS CO.
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Gentlemen: Send me free circular giving full details on the Duro Super-Power Unit and the low cost workshop units.

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Address.....

WANT A BASEMENT WORKSHOP?

BUILD a handy workshop easily with Gold Bond Gypsum Wallboard, at low cost. Big, lightweight panels are fireproof, moisture resistant, and easy to nail. Decorate with Gold Bond Sunflex, the low-cost, one-hour wallpaint. Get both at your local Gold Bond Lumber and Building Material Dealer's.

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Gentlemen: Send free copy of new Booklet, "Modernizing Magic" showing remodeling ideas and methods:

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City..... *State*.....

(Please print name and address.)

The JIFFY metal CABINET

YOUR ANSWER TO SMALL ITEMS STORAGE
at home, office, and shop
(ideal gift, too)

So handy to keep nuts, bolts, screws, nails, parts, washers, stamps, hobbyists' needs, etc., at your fingertips.

THIS 32 DRAWER UNIT ONLY **$5.95** POSTPAID

Stop searching, get a 32 or 64 drawer Jiffy to keep those small items that usually get mislaid. Spot welded steel, gray enamel finish, metal drawer guides. Dividers included with aluminum drawers make possible three compartments per drawer. Looks good anywhere. Send check or money order, please—no C. O. D.'s. Prices below. Your money refunded if not satisfied. Dealers write for quantity discount.

SPECIFICATIONS	WITH ALUMINUM DRAWERS	WITH CARDBOARD DRAWERS
32 Drawer Unit 6" Deep 12¼" Wide 15¼" High **64 Drawer Unit** 6" Deep 25½" Wide 15¼" High **Drawer Size** 1¼" Deep 2¾" Wide 6" Long	**Dividers and Index Cards Included** One piece rustproof aluminum drawers for heavy service — good for work bench and industry use. **32 drawer - $8.95** **64 drawer - $15.95** Marproof Rubber Feet included with all cabinets POSTAGE PAID	Suitable for most home uses. Heavy board kraft covered. Metal drawer pulls. **32 drawer $5.95** **64 drawer $9.95** POSTAGE PAID

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SERRATED JAWS FOR POSITIVE GRIP

SEYMOUR SMITH
"Snap-Lock"
PLIER-WRENCH

SWIVEL JAW

ALL-NICKEL FINISH

CAPACITY INDICATOR

Only Locking Plier with All These Features

A plier, wrench, clamp; 1000's of uses in garage and home. Heavy pressed steel body, rugged tool steel, replaceable jaws. 7" size, $1.75; 10", $2.25 (10% higher, Denver & West). At dealers everywhere.

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AMAZING PERMANENT MAGNETS — WILL NOT WEAKEN! NON-ELECTRIC. Retrieve guns, tackle, tools and other steel items from lake, river, plating tanks, drains or other hard-to-reach spots. Recover drills, taps, etc. from floor sweepings. Clear alley of harmful tacks, nails. Many other uses listed. Pays for itself quickly. GUARANTEED: Try any magnet one week. Money refunded if you are not well-pleased.
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All necessary lapidary equipment is furnished, including a super-charged diamond blade for sawing, and all wheels for grinding, shaping and polishing; also complete instructions. The complete equipment as shown, less motor and belt, for only $29.50, f.o.b., Burlington, Wisconsin. Write today for information and literature.

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Decorative METAL WORK

A new manual for the amateur. Tells in easy to understand language how to make useful metal articles in your home workshop. You'll be surprised how easy and interesting metal work really is. **Fully illustrated** with diagrams and step-by-step instructions. Sturdy cloth binding. 253 pages. Send only $2.00 and your copy will be sent postpaid. **Popular Science Monthly—Dept. 109, 353 4th Ave., New York 10, N. Y.**

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WESTINGHOUSE AIR COMPRESSOR

2-CYLINDER PISTON TYPE

Operates with 1/2 H.P. Motor or equivalent gas engine.

Complete outfit consisting of compressor, pressure tank, air gauge, air chuck, 20-ft. hose, pop valve, copper tubing with 4 brass flared fittings for connecting compressor to tank, 4-way cross and 3 nipples. Complete outfit of 7 items.....ONLY $29.95 SHIPPING WT. 40 LBS.

COMPRESSOR SEPARATELY.....$21.50

Equipment less compressor.....$10.50 Wt. 15 lbs.

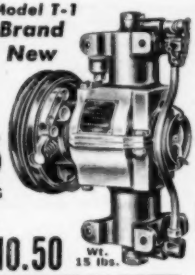
IDEAL for HOME • FARM • FACTORY

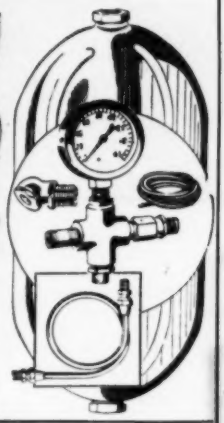
Wherever Compressed Air is Needed

For spraying paints, insecticides, etc.; inflating tires, operating air tools and many more uses. Automatic clutch makes it suitable for mounting and operating from trucks, tractors, etc. Instructions furnished. A fortunate purchase from the government enables us to offer you this amazing buy. All brand new equipment. Replacement parts available.

This low price is but a fraction of the price of manufacturer and of leading mail order houses.

Model T-1 Brand New





THE COMPRESSOR

Piston Type, 2-cylinder, 2 inch bore, 1½" Stroke Ball Bearing. 3.27 C.F.M. at 600 R.P.M. Capacity up to 6.54 C.F.M. Suggested operating pressure 75 P.S.I. DIMENSIONS: 9" wide, 11⅞" high, 6⅝" deep. Wt. 26 lbs.

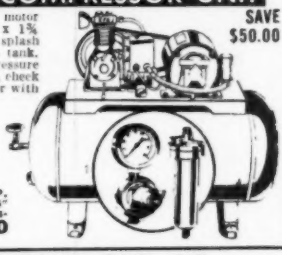
TANK and ACCESSORIES

6" x 24" stainless steel tank suitable for 150 lb. pressure. Two ¼" openings. Air gauge, pop valve, air chuck, 20 ft. hose, Copper tubing and fittings as shown. Wt. 15 lbs.

AUTOMATIC COMPRESSOR UNIT

1/3 H.P. heavy duty (capacitor) motor AC 110/220 volt 60 cycle. 2 x 1¾ inch piston type compressor, splash feed lubrication. 12 x 24 inch tank, automatic pressure switch, pressure range 100 to 125 lbs. CFM 2.2, check valve, safety valve, air regulator with gauge and filter. 20-ft. air hose with air chuck for inflating tires. V. belt drive. Shipping wt. 90 lbs.

SAVE $50.00



Special Price $79.50

Same unit as above with 1/2 H.P. motor, furnished with 13" x 24" tank. CFM 2.8 at 125 lb. pressure. Shipping wt. 125 lbs.....$98.50

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External Atomizing

SPRAY GUN

Flat and round spray, quart cup. Requires 2 c.f.m. at 35 to 40 lbs. pressure. Ideal for spraying lacquer, synthetic enamel, lead paint, etc.

Spray gun with 20 ft. hose and fittings. Wt. 7 lbs.....$12.95

Spray gun only; wt. 5 lbs.....10.00

Prices f.o.b. Chicago. Immediate delivery. All items sold on money back guarantee. Send check or money order today. Catalog FREE.

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GIGANTIC MAIL SALE! CLOSEOUT WAR SURPLUS ITEMS

WELDING GENERATORS! G.E. D-C 275 to 375 Amp. ORIGINAL COST over $275.00

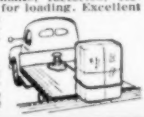
Brand New. Genuine G.E. Generators. Ready to operate. Build and repair your own machinery. Do professional work for pay. Drive with tractor, old auto engine, or electric motor. Hundred uses. Complete with instructions on "How to Weld". Sale price, frt. pd.....**$89.90**

Same unit with helmet, rods, holder, cables, etc., frt. pd. $104.50.

INDUSTRIAL CAPSTAN WINCH 3000 LBS.

MOUNT ON TRUCK, TRACTOR, BOAT, ETC.

Finest steel and bronze drive gears. 80 to 1 power ratio. Useful for farmers, truckers, merchants, factories, etc. Used by leading truck lines for loading. Excellent for hay hoist. Drive with old car 6-volt starting motor, power take-off, fan pulley, etc. Instructions.

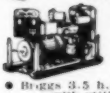


HUNDREDS OF USES. Easily mounted on tractors, trucks, docks, jeeps, etc. Many practical uses. Pays for itself quickly. Original cost over $75.00.

Sale price, frt. pd.....**$24.95**

3000 W 110V-60C POWER PLANT

Ideal Farmers, Sportsmen, Contractors



110-volt, 60 cycle, 3000 watt. Remote switch, electric self-starter. Easily made automatic start. Fine instrument control panel. Army's finest plants. Full maintenance—operation instructions. New condition. Cost Gov't. $750.00. This marvelous plant—freight prepaid. Also lower price plants (Write for details).

$345.00

Other Items Include:

- Briggs 3.5 h.p. Gas Engines.....$77.50
- with utility clutch.....87.50
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- Telephones $4.99. Rotary Pump $3.95. Selsyn Motors, Pair 3.39
- Dozens other sale items. Radio, electronic, electrical, etc.

Order from ad or write for illustrated sales catalog. We pay all freight to you.

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ONE TRACTOR DOES 17 JOBS!

SEE THE POWERFUL 5-H.P. GRAVELY—

the world's finest, yet most moderately priced Garden Tractor. Complete line of exclusively designed power tools for every Garden, Lawn and Field job.

GRAVELY TRACTOR

FIELD-TESTED FOR 27 YEARS

MAIL NOW! FOR NEW **FREE BOOKLET!**

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SOLVING YOUR LAWN & GARDEN PROBLEMS

Stop Drafts! Save Fuel!
WEATHERPROOF YOUR HOME
WITH Nu-WAY
WEATHER STRIP

Easiest strip in the world to put on. Can be used on most any type door or window. Wool felt, reinforced with white metal.

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MACKLANBURG DUNCAN CO. QUALITY PRODUCTS
BUY AT YOUR LOCAL HARDWARE STORE, BUILDING SUPPLY DEALER OR LUMBER YARD

SAVE YOUR EYES

$1.00 for 2
AVOID EYESTRAIN
Use LEK-TRO-LENS on Your Lamps
Clever New Clip-On Lens For Reading • Sewing • Hobbywork • Fits 25 to 100 watt bulbs in lamps & light fixtures • Focuses twice the light • Swings to any position • Send Dollar Bill plus 6¢ postage now for 2
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GET "TWICE THE LIGHT" TODAY!
IMMEDIATE DELIVERY
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SATISFACTION GUARANTEED
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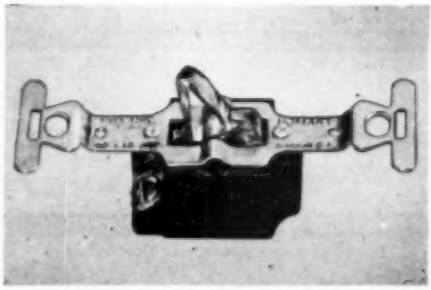
NEW! Trash Disposal Unit Burns Refuse Safely

● A new type outdoor dispose-all unit safely and quickly burns garbage and trash in any weather. All refuse, damp, green or dry is fully consumed. Scientific draft design completely eliminates fire hazard of flying ash, sparks, burning, blowing bits of paper. Intense combustion removes neighbor-annoying nuisance of flying scraps, smoke, smell. Sturdily built to last for years. Nothing to get out of order. Needs no watching. Will not blow over. Will not destroy grass or shrubs. Ends refuse hauling and fire hazards to quickly pay for itself. Measures 23" square at base by 40" high. Weighs 19 lbs. Over 2 bu. capacity. Recommended by Bureaus of Fire Prevention. Full price $9.95—nothing else to buy. Sent F.O.B. Cleveland. Money back guarantee. Send check, cash, or money order to:

ALSTO COMPANY, Engineers Bldg., Dept. PS-10, Cleveland, Ohio

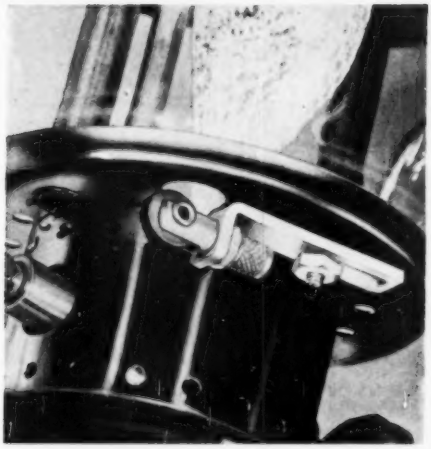
Aids to

Multiple-Action Rolling Pin. Instead of one roller, this Bakelite® rolling pin has eight small ones. The maker, the Magnus Harmonica Corp., Newark, N. J., says that since the small rollers run over the dough oftener than one large one, the dough can be rolled thinner more quickly. A frame 7 inches in diameter holds the ½-inch rollers. The price is about $1.70.



Switch Has Neon Lamp. Within the housing of this wall switch is a tiny neon lamp that directs light to the transparent-plastic switch handle. It glows only in the off position as a guide in the dark, and uses only about 10 cents' worth of current a year. It's priced at about $1 by Sears, Roebuck and Co.

Modern Living



Lighter Bolts to Lantern. Working like a cigarette lighter, this gadget lights a gasoline lantern at the spin of a wheel. Tim's E-Z Lite® is made to fit all makes of gasoline lanterns, according to the distributor, Timcor, Inc., of Cleveland, O. One bolt holds it to the lantern. The lighter also fits gasoline lamps, stoves, and heaters. It's priced at about a dollar.

Pie Pan Has Juice Groove. Instead of dribbling into the oven, juice that overflows a pie goes into the juice groove when one of these tins is used. The pans, made of 24-gauge aluminum, take a standard 9-inch pie. Two pans fit the average oven. They're priced at two for 97 cents from Walter Drake, Colorado Springs, Colo.

now

PAINT EASIER!

PAINT SMOOTHER!

PAINT CLEANER!

PAINT FASTER!

Rubberset's amazing new self-feeding FLO-MATIC Pressure Roller lets you paint smooth as a professional painter!

Lays smoothest coat of paint you ever saw! Now you can paint as expertly as a Master Painter! Actually paint *twice* as fast . . . and with results that any professional painter would be proud of!

Carries its own paint supply! Why fuss with dripping brushes? Rubberset's FLO-MATIC *carries its own paint supply* in the high-strength aluminum alloy cylinder handle. Takes only seconds to fill, paints *continuously!*

Easy as pressing a button! One coat covers perfectly! Just press gently on the pressure valve tube and r-o l-l the paint on *any* surface—smooth or rough, interior or exterior!

Save money! Save time! Save effort! Not one drop of paint is wasted when you paint with FLO-MATIC! And FLO-MATIC lays such a smooth, even coat of paint that the paint goes further!

Only $29.75

Easiest way to paint ceilings—No dripping! No splashing!

Don't paint an inch until you get *full information* about this *newest, easiest* way to paint! *Mail the coupon today!*

Rubberset Co.
146 Haynes Ave.
Newark 5, N. J.

PS-109
(Mail in envelope or paste on postcard)

Mail me FREE complete information about the FLO-MATIC Pressure Paint Roller that lets me paint as expertly as a professional painter.

Name.....

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City.....Zone.....State.....

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Rubberset Co. World-famous for the finest in painting tools

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The New and Modern Way

STOR-A-WAY

HANGS STORM WINDOWS and SCREENS

Pat. No. 2,455,546

Finally, a storm window and screen storage hanger that will save you money, time and effort. The *Stor-A-Way* Hanger protects your window sashes—hangs storm windows and screens above the damp basement or garage floor—prevents warping of frames—reduces glass breakage—keeps the basement or garage neat and tidy.

Easy to install and operate. *Stor-A-Way* Hanger brackets are made from sturdy aluminum (will not rust) and are screwed or nailed to garage or basement joists. Window sashes slip on and off with ease—just slip sash between holding brackets and release—needs no adjusting—will last a lifetime.

Will hang windows vertically or horizontally. Installation instructions accompany each order.

6 window set (2 brackets).....**$1.88** plus 12c mailing
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20 window set (6 brackets).....**$4.95** plus 20c mailing
27 window set (8 brackets).....**$6.10** plus 25c mailing
34 window set (10 brackets).....**$7.83** plus 30c mailing
41 window set (12 brackets).....**$9.60** plus 35c mailing

Order now for immediate delivery—money refunded if not 100% satisfactory. Send cash, check or money order for full amount plus mailing cost.

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Distributors and Dealers Write

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Stripping finishes no longer means hours of arm-tiring work. Wonder-Paste Remover has changed all that!

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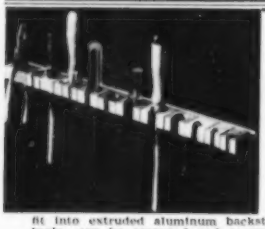
Equally effective on paint, varnish, enamel, lacquer, or shellac. Simply apply this powerful solvent with a paint brush. Allow time for it to penetrate completely. Then remove the soft, sludgy mass with a putty knife. Leaves the surface clean and smooth—no sanding needed.

Get Wonder-Paste at your paint or hardware store. *Or write us for leaflet.*

Wilson-Imperial Company, 121 Chestnut Street, Newark 5, N. J.



TOOLS STAY SHARP ALWAYS HANDY in

TOOLRAK

Your tools at your fingertips—an ideal arrangement for everyone who uses tools. TOOLRAK prevents dulling and marring, keeps tools always ready for instant use. Selected hardwood blocks fit into extruded aluminum backstrip, hold wide variety of tools, can be arranged and rearranged in any sequence. A handy shop and household accessory, a thoughtful gift.

ORDER TOOLRAK DIRECT

18" size holds 14 tools, **$2.65** postpaid
12" size holds 10 tools, **$2.00** postpaid
8" size holds 7 tools, **$1.35** postpaid

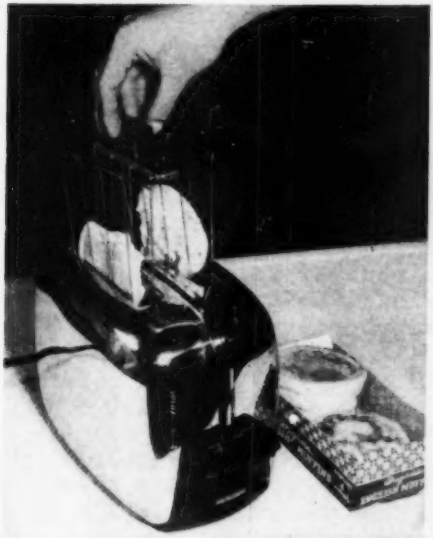
C.O.D. if desired; fees added. Colo. residents add 2% tax. Satisfaction guaranteed.

DAVIS DEVELOPMENT CO. Bldg. T-352A, Peterson Field Colorado Springs, Colorado

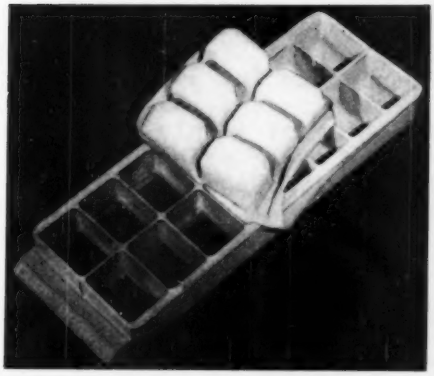
Aids to Modern Living

Converts Bottle to Lamp. Making a lamp of almost any vase or bottle is simple with these adapters offered by W. N. de Sherbinin, of Brookfield, Conn. The cork section comes in three sizes—1¼, 1¾, and 2¼ inches. It's a circular cork strip that can be peeled down, if necessary, to conform to the bottle neck.

Faucet to Fountain. The Handy Ann Faucet® attaches to a faucet by a rubber coupling. Push the lever up and it's a fountain. When you shut off the water, the lever drops and it is a faucet. It's especially handy for children. Handy Ann Products, Minneapolis, prices the nickel-plated, rust-proof gadget at $2. It has a built-in screen that prevents splashing.



Lifts Toasted Muffins. Toast Lifter®, distributed by Benjamin & Medwin Inc., New York City, is a stainless-steel cage that fits almost all two-slice, pop-up toasters. English muffins and other breads that won't reach the top of the toaster slots can easily be removed with Toast Lifter. The price is about $2.



Remove One Cube at a Time. A flexible latex liner in the Cube Drawer® makes it easy to remove only the number of ice cubes you need. According to the maker, Cube Drawer Corp., Akron, O., a single cube may be removed just by pushing up on the underside of its pocket. The drawer retails at about $2 and extra liners may be purchased separately if needed.

DEMAND GENUINE

Chromtrim

TRADE MARK

A PRODUCT OF R. D. WERNER CO., INC.

"Trim-it-Yourself"

METAL MOULDINGS

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FOR YOUR PROTECTION

EASY TO CUT

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EASY TO APPLY

Join the thousands who have beautified their homes, from cellar to attic ...yes, TRIM IT YOURSELF with high-lustre CHROMTRIM and erase years from rooms in a matter of minutes! Insist on CHROMTRIM — the only line that was specially developed for home applications. The name CHROMTRIM is on every, ready-wrapped, 6-foot length . . . don't accept substitutes!

Serve yourself from this colorful Chromtrim floor display at your favorite store . . . choose from the 12 popular Chromtrim shapes that help modernize your home in hundreds of ways!

SEND FOR YOUR "TRIM IDEAS" BOOK!

R. D. WERNER CO., INC., 295 Fifth Avenue, N. Y. 16

Enclosed is 10c. Please send me a copy of your 16 page full color booklet "Trim Ideas", telling me how to decorate with Chromtrim metal mouldings.

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P.S. Last minute news & notes...

THE MOSQUITO that zings you next year might make a little click in a Geiger counter. But don't let it worry you or waste your batteries. Army doctors are now rearing the little hummers in "hot" water in the hope that radioactive skeeters will signal how the pests migrate.

MORE LIGHT is coming in smaller packages. The 150-watt bulbs now being manufactured by Westinghouse are an inch shorter and a quarter-inch slimmer than the old bright-light jobs. Easier to get into that fixture over the bathroom mirror.

NOW THEY TELL US that garbage cans don't have to stink. Monsanto chemists have cooked up something to halt the molds and bacteria which decompose the garbage to produce the stench you don't love to uncover. Just ask for "Orthobenzylparachlorophenol."

NUMBERS instead of colors are being used to code wires for complicated electrical controls. The numerals are branded on every inch of insulation and won't wash or wear off. The makers (Midwest Automatic Control Co., Des Moines) unimaginatively call it "Magic Wire". Harassed electricians, contorting themselves through today's elaborate circuits, think "Number Please" might be more appropriate.

DISHWASHERS that call for less work on the part of the housewife than washing the dishes herself are every husband's dream. A new principle, developed by Husband Jerry LaRaus of Westport, Conn., uses jets that do the job on both sides of the plates.

SCIENTISTS are excited over the latest news from Berkeley, Calif., that a quarter-scale model of the proposed 5 to 7 BILLION volt "bevatron" is now running sweetly. Tests show that plans for the biggest atomic accelerator ever designed are basically okay. The big-billion job ought to be ready in three or four years.

GAR WOOD's new boat is not idly named "Venturi." It's a seagoing windtunnel that steadies itself by squeezing the air that rushes through the square gullet formed by its split hull and curved underdeck.

The Editors

HOLIDAY... every day!

To MAKE NEW FRIENDS FOR HOLIDAY

Cool-smoking aluminum pipe with genuine imported briar bowl

Here's a Sensational PIPE OFFER!

3.50 *only* 50¢ *plus* the inside paper wrapper from 12 tins of Holiday Pipe Tobacco.

Offer limited to U.S.A. Expires Dec. 31, 1949

Send to Holiday, Dept. PS-1, Richmond, Virginia

HOLIDAY

AROMATIC PIPE MIXTURE

Don't just paint it — let's use it!

Remember Weldwood Glue when you need dependable wood-to-wood bonds. Quick and easy to mix with cold water... tremendously strong... stain-free... rot-proof ... and *permanent*. At paint, hardware, variety stores and lumber yards. 15¢, 35¢, 65¢, 95¢ and larger sizes.

WELDWOOD PLASTIC RESIN GLUE

United States Plywood Corporation, New York 18, N. Y.

ALSO HANDY FOR WOOD HOBBYISTS!

Firzite

—to give you smooth finishes on fir plywood and other soft woods.

A pre-finishing material that seals the wood pores... tames the wild grain . . . virtually eliminates checking and grain raising. An excellent base for stain, paint or enamel. White or clear. White Firzite provides an easy, low-cost way to achieve "blond," "bleached" or "wiped" finishes.

Satinlac

—to preserve the beauty of all woods.

An inexpensive coating for the proper finishing of Weldwood Hardwood Plywood and similar woods. Clear. No brush marks. Brings out all the natural beauty of wood. Does not yellow or darken with age.

FIRZITE and SATINLAC are available from paint, hardware and lumber dealers. Write for leaflet No. 4 on finishing plywood.

THAT CUSHIONY FEELING LASTS LONGER WITH MARFAK!

There's a world of difference between *Marfak* chassis lubrication and ordinary grease jobs. Tough, s-t-r-e-t-c-h-y *Marfak* clings to wear points and fights friction for 1,000 miles and *more!* And just notice that "cushiony" driving ease that *lasts!* It's your sign that *Marfak keeps right on protecting.* Applied by chart, never by chance. Stop by for *Marfak* lubrication today at your neighborhood Texaco Dealer, *the best friend your car ever had.*

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Radio Mechanic For ...iz Line

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"Am doing Radio Servicing full time. Have my own shop and am making more money now than I ever did before. Owe this to N.R.I."—Curtis Staeth, Fort Madison, Iowa.

N.R.I. Graduate Doubles Salary

"I am employed by Station WKBO, as transmitter operator. Have more than doubled my salary since starting in Radio full time."—A. A. Herr, New Cumberland, Pa.

"I ave... fixing ... time. ... manag... store's ... ment." ... ramen...

BE A SUCCESS IN RADIO-T...

Learn by Practicing...

I SEND YOU MANY KITS LIKE THESE FOR PRACTICAL EXPERIENCE

Get a GOOD JOB--Have a BRI... in America's Fast Growing ...

Do you want a good pay job in the fast growing RADIO-TELEVISION Industry? Or do you want to have your own money-making Radio-Television Shop? Here is your opportunity. I've trained hundreds of men to be successful Technicians . . . MEN WITH NO PREVIOUS EXPERIENCE. My tested and proved train-at-home method makes learning easy. You learn Radio-Television principles from my illustrated lessons. You get practical experience building, testing and experimenting with MANY KITS OF PARTS I send. All equipment yours to keep.

MAKE EXTRA MONEY IN SPARE TIME

The day you enroll, I start sending you SPECIAL BOOKLETS that show you how to make $5, $10 a week or more EXTRA MONEY fixing neighbors' Radios in spare time while learning. From here, it's a short step to your own shop or a good pay Radio-Television servicing job. Or let me train you for a Federal Communications Commission (FCC) License. Be a Radio-Television operator or Technician.

TELEVISION ... MORE JOBS ...

In 1945, there w... Today, about 27... SULT—THOUSA... MEN STEPPED ... other example— ...tions were on t... more than fifty... 150, say the ... experts — and ... 1000 within 3 ... years. Then ... add developments in FM, Two Way Radio, Police, Marine, Aviation, Microwave Relay Radio. Think what this means for qualified men NOW can reap ... changing, develop...

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Act Now! Send ... Actual Lesson on ... 64-Page Book on ... Television. Cut ... J. E. SMITH, ... National Radio ... Study Radio Scho...

Make Extra Money While Learning

Many of my students earn money fixing Radios in their Spare Time while learning, often average $5 to $10 a week. I send you SPECIAL BOOKLETS that show how to do it . . . and I send parts to build a SET TESTER that helps you do it.

FIND OUT ABOUT THIS TESTED WAY TO BETTER PAY...

Makes $10 Week Extra In Spare Time

"I averaged $10 a week fixing Radios in my spare time. After graduating, managed an electrical store's Radio Department."—M. Joseph, Sacramento, California.

Has Radio Television Servicing Store

"Today I am considered an expert Radio and Television Technician. I have 4 employees working for me. Radio repair business has doubled."—Paul G. Miller, Toledo, Ohio.

Calls N.R.I. His "Stepping Stone"

"N.R.I. has been my stepping stone from a few hundred to over $4,000 a year as a Radio Engineer. Make extra money servicing Radios."—Alton B. Michaels, Trenton, Ga.

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here were 943 Radio Stations. but 2700 are on the air! RE-IOUSANDS OF QUALIFIED PPED INTO GOOD JOBS. Am-mple—only 19 Television sta-on the air in 1947. Today, fifty. Within a few months, the and n 3 hen lop-FM, Ra-ice, vin-ro-lay hink

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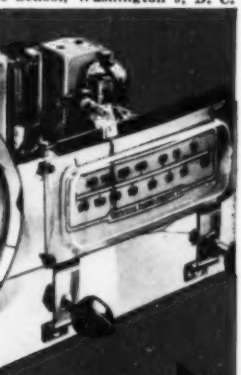

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